

MONTAGUE APS - AGRICULTURAL CLASSROOM AND BARN

PROJECT MANUAL

JUNE 30, 2026

OWNER

MONTAGUE AREA PUBLIC SCHOOLS

Central office
4882 Stanton Blvd.
Montague, MI 49437

PROJECT NUMBER

Architect's Project No. 22-136.03

VOLUME NUMBER 1

Divisions 00 Through 14

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1.1 EXISTING REPORTS AND SURVEYS

A. SUBSURFACE INVESTIGATION REPORT

B. A copy of a geotechnical report with respect to the building site is available for viewing:

1. Title: Report of Geotechnical Investigation for Montague Area Public Schools Additions.
2. Date: December 14, 2022 .
3. Prepared by: Soils & Structures, Inc.
4. View: 00 3110 "Geotechnical Report".

C. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of the Architect.

D. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in the Contract Documents.

E. 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 Price accruing to the Owner.

F. The soil boring logs from this report are included with this document.

END OF DOCUMENT 00 3100

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REPORT OF
GEOTECHNICAL INVESTIGATION
FOR
MONTAGUE AREA PUBLIC SCHOOLS ADDITIONS

MONTAGUE
MUSKEGON COUNTY
MICHIGAN

DECEMBER 14, 2022



*Montague Area Public Schools
4882 Stanton Boulevard
Montague, Michigan 49437*

Project No. 2022.2109



SOILS & STRUCTURES

December 14, 2022

Montague Area Public Schools
4882 Stanton Boulevard
Montague, Michigan 49437

Attention: Mr. Jeffrey Johnson

Regarding: Montague Area Public Schools Additions
Montague, Muskegon County, Michigan
Project No. 2022.2109

Dear Mr. Johnson:

Soils & Structures is pleased to present this geotechnical investigation report for the Montague Area Public Schools Additions project in Montague, Muskegon County, Michigan.

The investigation included eight (8) test borings drilled to depths of 15.0 and 25.0 feet in accordance with ASTM D 1586 procedures.

The report, test boring location plan and test boring logs are enclosed. The report provides recommendations for site preparation, foundations, fill, floors and pavement.

We appreciate the opportunity to provide engineering services to Montague Area Public Schools. If you have any questions regarding this report, please contact our office.

Sincerely,
Soils & Structures, Inc.

Malcolm P. Thompson, P.E.
MPT/mt

Reviewed by:

David W. Hohmeyer, P.E.



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- General Soil Profile
- Test Boring Logs
- Laboratory Tests
- General Soil Information



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Location of Soil Investigation

The soil investigation was located at the existing Montague Area Public School at 4882 Stanton Boulevard in Montague, Muskegon County, Michigan. The parcel number is 61-21-020-200-0007-00.

Purpose of Investigation

The purpose of this investigation is to provide geotechnical engineering recommendations for the proposed building addition, agriculture barn, and pavement.

Design Information

The project consists of a building addition, agriculture building and pavement. The building addition will extend northwest from the existing building. The building addition will be a one and two story steel frame structure with masonry walls and a slab on grade floor. A portion of the addition will include a poured concrete basement. The agriculture barn will be a one-story structure with a slab on grade floor. Pavement for this project will include parking areas and concrete hardscapes.

The maximum column load is anticipated to be less than 200,000 pounds. The maximum wall loads are anticipated to be less than 6,000 pounds per foot. Allowable settlements of 0.6 inches for total settlement and 0.4 inches for differential settlement are assumed. If the actual loads are significantly greater than the anticipated loads listed in this report, then Soils & Structures should be contacted so that the recommendations included in this report may be reviewed and revised if necessary.

The first-floor elevation of the building addition will be approximately 658.5 feet. The basement floor elevation of the building addition will be approximately 642.5 feet. The floor elevation of the agriculture barn has not been determined at the time of this report. Fill and excavation will probably be required to achieve the required grade in the construction area. The thickness of fill required to raise the grade is anticipated to be less than 8.0 feet. Fill for this project will also include backfill over foundations and utilities. The thickness of backfill over foundations and utilities is anticipated to be less than 18.0 feet.

The greatest depth of excavation is anticipated to be less than 18.0 feet which will be required for the for the construction of foundations and utilities. Dewatering with well points will probably not be necessary to construct foundations and utilities.

The standard-duty parking areas are assumed to be subjected to passenger vehicle traffic only, with no commercial truck traffic. An estimate of 250,000 lifetime Equivalent Single-Axle Loads (ESALs) over a service life of twenty years was assumed for the standard-duty pavement recommendations. The subgrade is assumed to be prepared as recommended in this report.



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Tests Performed

The investigation included eight (8) test borings drilled to depths of 15.0 and 25.0 feet. The test borings are designated as Test Boring One through Test Boring Eight. The locations were determined by Montague Area Public Schools. The locations were adjusted for accessibility by Soils & Structures as necessary. The test borings were conducted in accordance with ASTM D 1586 procedures. The ASTM D 1586 standard describes the procedure for sampling and testing soil using the Standard Penetration Test. An automatic hammer was used to obtain the soil samples.

The surface elevations at the test boring locations and additional points of reference were obtained with a Global Navigation Satellite System (GNSS) Receiver. The receiver was connected to the local MDOT CORS base station. Through this system, vertical measurements are obtained and referenced to the North American Vertical Datum (NAVD88). Horizontal measurements are also obtained at the test boring locations which are referenced to the Michigan State Plane Coordinate System. Both the vertical and horizontal measurements typically have an accuracy of approximately 0.5 inches. The measured test boring locations and surface elevations are represented in Table 1.

Table 1: Measured Test Boring and Points of Reference Locations and Surface Elevations

Test Boring / Location	Elevation Measured [feet]	Northing [feet]	Easting [feet]	Surface Cover
Test Boring One*	655.0	707369.0	12592631.2	Topsoil
Test Boring Two	656.7	707316.6	12592937.2	Asphalt
Test Boring Three	653.9	707341.2	12592708.9	Topsoil
Test Boring Four	655.3	707334.4	12592829.9	Sand
Test Boring Five	653.9	707262.7	12592761.0	Asphalt
Test Boring Six	652.3	707211.8	12592700.1	Asphalt
Test Boring Seven	658.2	707226.4	12592886.0	Concrete
Test Boring Eight*	663.9	706985.9	12593506.9	Topsoil
Base Setup VRS1	649.2	626295.6	12621445.8	-

* Potential Error: GPS Signal Interrupted

Soil samples were classified according to the Unified Soil Classification System. This method is a standardized system for classifying soil according to its engineering properties. Please refer to the appendix of this report for the Unified Classification System Chart. The classification is shown in the "Material Description" column of the test boring logs.



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The soil strength and the allowable soil bearing value were evaluated using the "N" value. The "N" value is the number of blows required to drive a soil sampler one foot with a standard 140 pound drop hammer. The sampler is driven a distance of 18.0 inches. The number of blows for each 6.0 inch increment is recorded. The sum of the second and third intervals is the "N" value. The number of blows for each 6.0 inch interval is shown on the test boring logs under the column labeled "Penetration." The "N" value for each sample is shown in the adjacent column.

Laboratory testing consisted of natural moisture content (ASTM D 2216), sieve analysis (ASTM D 6913) and unconfined compressive strength testing (ASTM D 2166). The tests were performed on representative soil samples. The tests were performed in accordance with the ASTM standards listed above. The water content documents the presence of groundwater in the soil. The sieve test determines the particle distribution which is used to classify the soil and estimate its properties. Unconfined compression testing determines the strength properties of cohesive soil.

The U.S. Geological Survey Topographic map and the Quaternary Geology map of Southern Michigan were reviewed. These maps provide general geological information about the region. Publicly available well logs were reviewed to determine the depth to bedrock.

Description of Soil

The general soil profile consists of a layer of sand which extends to depths of 12.5 to at least 25.0 feet over a layer of clay which extends to depths of 22.0 to at least 25.0 feet. Portions of the upper sand layer may be fill placed during construction of the existing building and pavement. The natural sand is a lacustrine, or lake deposit from a former high-water stage of Lake Michigan. Lake sediments typically form layered strata and are characterized by relatively uniform gradation. The natural clay is part of a glacial end moraine. The end moraine is a geological formation consisting of glacial till in which clay is the primary soil type. Bedrock appears to be present at a depth greater than 160.0 feet.

Topsoil is present at the surface in the areas of Test Boring One, Test Boring Three and Test Boring Eight. The topsoil thickness ranges from 11.0 to 16.0 inches.

Pavement is present at the surface in the areas of Test Boring Two, Test Boring Five and Test Boring Six. The pavement consists of 2.5 to 4.0 inches of asphalt over 8.5 to 18.0 inches of what appears to be an aggregate base. Concrete is present at the surface in the area of Test Boring Seven. The concrete thickness is approximately 6.25 inches.



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The sand layer consists primarily of brown fine to medium sand with varying amounts of gravel. The fines content is low and is less than 7.0 percent, indicating the sand is porous and free draining. The "N" values of the sand layer range from 4 to 22, indicating the sand is in a loose to very compact state. The sand should have an internal friction angle of 30 degrees or greater and a California Bearing Ratio of 10 or greater when it is compacted to 95.0 percent of its maximum density. The sand layer will support foundations, floors and pavement following site preparations including the compaction of loose sand.

The clay layer consists of brown to gray low plasticity clay. The "N" values of the clay layer range from 11 to 22, indicating the clay is in a stiff to very stiff state. The undrained shear strength is in the range of 2100 to 5600 pounds per square foot, also indicating the clay is in a stiff to very stiff state. The clay layer will support foundations following site preparations.

Description of Groundwater Conditions

The water table is present at depths between 23.0 and 24.0 feet in the areas of Test Boring Four through Test Boring Six. These depths correspond to elevations between 629.3 and 631.3 feet. Perched groundwater is present at depths between 18.0 and 19.0 feet in the areas of Test Boring Three and Test Boring Six. Groundwater was not encountered in the remaining test borings. Seasonal precipitation will influence the perched groundwater elevation. Long-term groundwater monitoring was not performed as part of this evaluation.

Description of Site

The site is located at 4882 Stanton Boulevard in Montague, Muskegon County, Michigan. The site is an existing school complex. The north side of the site is bordered by a field and residential buildings. The east side of the site is bordered by the existing school building and pavement. The south side of the site is bordered by Stanton Boulevard. The west side of the site is bordered by the school's parking lot and Cook Street. The surface elevation of the site ranges from 652.3 to 658.2 feet. Photographs #1 and #2 show the site at the time the test borings were performed.



Photograph #1: View of the north portion of the site. The view is to the east. (Project No. 2022.2109, Montague Area Public Schools Additions, Montague, Muskegon County, Michigan, October, 2022)



Photograph #2: View of the center of the site. The view is to the southeast. (Project No. 2022.2109, Montague Area Public Schools Additions, Montague, Muskegon County, Michigan, October, 2022)



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Settlement

The maximum settlement of the buildings is anticipated to be less than 0.5 inches provided the recommendations in this report are observed including subgrade preparation. Differential settlement will be approximately one half of the maximum value. These levels of settlement are within the recommended acceptable limits of 0.6 inches of total settlement and 0.4 inches of differential settlement.

Recommendations

Site & Subgrade Preparation

Existing pavement, trees, and vegetation in the construction area should be cleared and removed as part of subgrade preparation. The topsoil should be removed to the extent that all soil with an organic content of 3.0 percent or greater is removed. Soil containing roots should be removed to the extent that the root content by volume is 5.0 percent or less. All roots over 0.5 inches in diameter should be removed. The anticipated thickness of topsoil to be removed is 16.0 inches or less.

The construction area should initially be excavated to the required subgrade level. In situ sand below foundations, floors and fill should be compacted to 95.0 percent of its maximum capacity to a minimum depth of 3.0 feet. Sand not meeting this requirement should be recompact or removed and replaced with MDOT Class II fill. The subgrade should be inspected and tested to determine if soft or wet clay is present below foundations, floors, and fill. Soft clay should be removed and replaced with sand meeting MDOT Class II specifications. For this project soft clay is defined as clay with a shear strength of less than 1500 pounds per square foot as measured with a hand penetrometer.

Soil brought to the site for fill should be clean sand meeting MDOT Class II specifications. Fill should be placed in accordance with the "Fill" section of this report. The fill should be compacted to 95.0 percent of its maximum density, as determined by the modified proctor method per the ASTM D 1557 standard. The soil which will be used for fill should be kept free of topsoil and other organic materials. Compaction tests are recommended to check the compaction of the new fill.

Additional exposure to moisture as a result of precipitation events or accumulated surficial runoff will weaken the clay's support capacity. The contractor should be prepared to perform temporary dewatering in all excavations which extend into the clay layer to accommodate accumulated precipitation. The exposed subgrade should be graded to accommodate proposed site grades and establish positive drainage. In wet conditions improvements consisting of undercutting of the clay subgrade may be required.



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Pavement subgrade, subbase, and aggregate base should be proof rolled using a fully-loaded tri-axle dump truck. The proof roll should consist of single, overlapping passes. Areas that experience yielding during the proof roll should be recompacted.

Foundations

Spread foundations are recommended to support the buildings provided the subgrade is prepared as discussed in this section as well as the "Site & Subgrade Preparation" and "Fill" sections of this report. The foundations are anticipated to be supported on compacted fill or the in situ soil following site preparation.

In situ sand below foundations should be compacted to 95.0 percent of its maximum capacity to a minimum depth of 3.0 feet. Sand not meeting this requirement should be recompacted or removed and replaced with MDOT Class II fill. If foundations are constructed on clay, the clay should be dry and level to ensure proper contact between the subgrade and concrete. Prior to pouring the foundations, the clay should be tested with a pocket penetrometer or torvane to ensure adequate strength to support the foundations. The natural clay under foundations should possess a shear strength of 1500 pounds per square foot or greater. Clay with a lower shear strength should be removed to its full extent under foundations.

Fill below foundations should be compacted to a density of 95.0 percent of the soil's maximum density to its full depth. Compaction tests should be performed in the foundation subgrade to verify these levels of compaction. Soils not meeting or exceeding the minimum density should be recompacted.

The recommended minimum cover over exterior foundations is 42.0 inches for protection against frost heave.

Foundations should not be constructed on frozen soil. During cold weather construction, the foundation subgrade and foundations should be protected from freezing with insulated blankets until backfill is placed over both sides of the foundation. Foundations that are damaged by frost heave should be replaced.

The site classification for seismic design is "D" based on the Michigan Building Code provided the recommendations in this report are observed. The site has a peak ground acceleration of 0.069g with a 2.0 percent probability of exceedance in 50 years. The mapped spectral accelerations are 0.063 for the short-term response (S_s) and 0.040 for the one second response (S_1). The corresponding numeric seismic design values for the spectral response acceleration parameters above are 0.067g (S_{DS}) and 0.065g (S_{D1}) respectively.



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Foundations may be designed using an allowable soil bearing value of 3,000 pounds per square foot for isolated column foundations and 2,500 pounds per square foot for wall foundations provided the recommendations in this report are observed. A minimum width of 16.0 inches is recommended for new foundations. The allowable bearing values may be increased 25.0 percent when considering transient loads such as earthquakes and wind.

Floors

A slab on grade is recommended for the floors. The subgrade should be prepared as described in the "Site & Subgrade Preparation" section of this report.

A base of 6.0 inches of clean sand is recommended under the floors. The sand should meet MDOT Class II specifications. Fill under floors should be compacted as described in the "Fill" section of this report. The clean sand layer present near the surface may be used for the sand base. Soil that contains organic materials or has a high clay content should be replaced.

A vapor barrier is recommended under the floor. The vapor barrier should consist of a 10 mil polyethylene sheet and should be located immediately below the floor slab.

A modulus of subgrade reaction of 150 pounds per cubic inch is recommended for the design of slabs on grade.

Lateral Earth Pressure

Foundation walls with different soil levels on either side should be designed as retaining walls. Sand should be used as backfill behind retaining and foundation walls. The sand should meet MDOT Class II specifications. The cantilevered walls should be designed using a soil density of 120 pounds per cubic foot and a coefficient of active earth pressure of 0.30 for level sand backfill. Braced excavations and foundation walls that will be braced against lateral movement at the top of the wall should be designed using a soil density of 120 pounds per cubic foot and a coefficient of at rest earth pressure of 0.45 for level sand backfill. The effects of any surcharge or sloping backfill should also be included in the design.

Excavations

The in situ sand and fill are OSHA type "C" soils. Excavations that will be entered by personnel should be based on OSHA requirements for a type "C" soil. Based on OSHA requirements, a maximum allowable side slope of 34 degrees (1.5H:1V) is recommended for excavations 4.0 to 20.0 feet deep. Excavations less than 4.0 feet deep may have vertical side slopes. Temporary or permanent earth retention may be required for excavations adjacent to structures such as the existing building which limit the available space for appropriate sloping or benching.



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Fill

Fill, including the aggregate layers under pavement, should be compacted to a density of 95.0 percent of its maximum density to its full depth. The maximum density should be determined in accordance with the ASTM D 1557 standard. A maximum thickness per layer of 6.0 inches is recommended. In sand the lift thickness may be increased to 12.0 inches if a vibratory roller or loader is used for compaction.

Where free draining porous fill is required, the fill should be sand meeting MDOT Class II requirements or ASTM requirements for a SP or SW which are the designations for clean sand.

Compaction tests are recommended to confirm that the fill is compacted to the required density. Fill should not be placed over frozen ground, snow or ice. Soil which contains frozen material should not be used as fill. During winter construction, removal of frozen ground may be necessary prior to placing fill.

Groundwater Management

Dewatering with well points to control groundwater will probably not be necessary to construct foundations and utilities. Temporary ditches, sumps and ditch pumps may be necessary to control perched water and surface water. The exposed subgrade should be graded to accommodate proposed site grades and establish positive drainage. If excavations encounter groundwater, the excavation bottom may be stabilized by placing a 6.0 to 8.0 inch layer of porous stone over the bottom of the excavation. The stone will stabilize the bottom of the excavation.

Infiltration rates for the upper layer of in situ sand should be suitable for internal drainage of the site. Sand meeting MDOT Class II specifications is recommended in areas where increased drainage is required.

The clay layer does not meet the exception for drains in Section 1805.4 of the Michigan Building Code. Drains around the exterior basement foundations are recommended. The drains should consist of a 4.0-inch diameter slotted plastic pipe wrapped in filter fabric. Pea gravel should be used for backfill within a 6.0-inch circumference of the drain.

Pavement areas should be properly drained to minimize the effects of frost heaving and the loss of subgrade due to water infiltration.



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Hot Mix Asphalt (HMA) Pavement

The recommended pavement section materials listed in Table 2 refer to and should comply with the standard material designations included in applicable MDOT specifications and guidelines, including the 2012 MDOT "Standard Specifications for Construction." These recommendations were developed based on the discussions and assumptions included in this report and the design procedures outlined in the "AASHTO Guide for Design of Pavement Structures - 1993." The subgrade should be prepared as described in the "Site and Subgrade Preparation" section of this report. The final pavement section should be designed based on actual traffic volumes and the owner-specific performance requirements.

The design life assumes that maintenance repairs such as joint sealing, patching, and overlays are regularly performed throughout the life of the pavement. The design life also assumes that proper drainage has been established throughout the site. Proper drainage includes the installation of a storm system and structures and establishing positive drainage in the subgrade and the pavement cross-section layers.

Table 2: Recommended Pavement Section

Pavement Cross Section Materials	Standard Duty		Heavy Duty	
	Material	Thickness (in)	Material	Thickness (in)
HMA Wearing Coarse ¹	5E1	2.0	4E1	2.5
HMA Base Coarse ²	4E1	2.0	4E1	2.5
Aggregate Base	21AA Crushed Limestone	8.0	21AA Crushed Limestone	10.0
Sand Subbase	Class II	12.0	Class II	12.0

Note 1: If necessary, geogrid used to mechanically stabilize subgrade should be placed between the subbase and the proposed aggregate base. It should consist of a tri-axial configuration (such as Tensar TX-140 or similar). Segments must be overlapped by a minimum of 12.0 inches.

The recommended asphaltic binders are PG64-28 for the wearing and leveling course. A softer binder may be necessary to achieve desired performance characteristics when utilizing Tier II RAP contents, per the MDOT Special Provision for Recycled Asphalt Pavement.

Target void content should be 3.0 percent. The paving contractor should submit the proposed mix design to the owner for review and approval prior to placement. The asphalt pavement should be compacted to 94 to 97 percent of the theoretical maximum density, determined via the Superpave "Rice" Method. Additionally, a tack coat of SS-1h emulsion should be applied between each asphalt layer at a rate of 0.1 gallon/square yard.



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The paving contractor should submit the proposed mix design to the owner for review and approval prior to placement. The HMA pavement should be placed in at least two lifts. The pavement section should be constructed in accordance with MDOT guidelines and specifications as well as applicable state and local requirements.

Paved areas that display poor workmanship, which may include segregation, "cold screed scrapes", wearing courses not flush with curbs or rims, roller marks, shoving, smearing or tearing of the mat, flushing, or excessive cold joints should be repaired or replaced by the contractor immediately.

The pavement section should be constructed in accordance with MDOT guidelines and specifications as well as applicable state and local requirements. Support conditions and compaction should be assessed during construction in accordance with the "Quality Control and Testing" section of this report. This assessment should occur prior to installation of individual pavement layers.

Portland Cement Concrete (PCC) Pavement

The subgrade should be prepared in accordance with the "Site & Subgrade Preparation" and "Fill" sections of this report and applicable MDOT guidelines and specifications.

A base of 12.0 inches of clean sand is recommended under concrete pavement. The sand should meet MDOT Class II specifications. A minimum slab on grade concrete pavement thickness of 4.0 to 6.0 inches is recommended for standard and heavy duty concrete pavement. The recommended minimum concrete thickness in the area of dumpster pads is 8.0 inches. A structural engineer should design any reinforcing steel used to promote load transfer between slabs.

A base of at least 6.0 inches of MDOT Class II sand or 21AA crushed limestone aggregate is recommended for underneath sidewalk slabs. Soil that contains organic materials or has a high clay or silt content should be replaced. The recommended minimum concrete pavement thickness is 4.0 inches for sidewalks hemmed in by greenbelt, or 6.0 inches for revealed-face.

A modulus of subgrade reaction of 150 pounds per cubic inch is recommended for the design of concrete pavement provided the recommendations in this report are observed. The paving contractor should submit the proposed mix design to the owner for review and approval prior to concrete placement.



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Quality Control Testing

The subgrade should be examined and tested after the topsoil is removed and before fill is placed. A density gauge and probe rod should be used to verify that the subgrade possesses the required compaction.

Compaction tests in accordance with ASTM D 6938 procedures are recommended to confirm that fill in the construction area is compacted to the specified density. While fill is being placed, compaction tests should be performed at the rate of one test per 400 cubic yards of fill and throughout the depth of the fill with a minimum of five tests at each 1.0 foot elevation interval. Compaction tests should be performed under foundations at the rate of one test per 50 linear feet for wall foundations and one test per column foundation. The recommended testing frequency in the floor and pavement subgrade is one test per 2500 square feet. Tests should also be performed in the backfill over foundations and utilities. The maximum density should be determined in accordance with ASTM D 1557 or ASTM D 4253 procedures.

The shear strength of clay should be checked with a hand penetrometer or torvane. The tests should be performed at the same frequency as compaction tests.

A smooth 0.5 to 0.75 inch diameter rod should be used in conjunction with compaction tests to probe for loose areas under foundations, in fill and under floors.

A dynamic cone should not be substituted for compaction tests for evaluating backfill.

Pavement subgrade, subbase, and aggregate base should be proof rolled using a fully-loaded tri-axle dump truck prior to aggregate base and pavement placement.

Asphalt quality control testing should adhere to the 2012 MDOT Standards for Construction. Asphalt temperatures during placement should be at least 275 degrees Fahrenheit; material that arrives at temperatures below 250 degrees Fahrenheit shall be rejected. Asphalt density testing should be performed with a nuclear density gauge at a minimum rate of one test per 500 square feet of pavement. At least five total verification cores in each course should be taken to assess relative compaction, calibrate the nuclear density gauge, and evaluate thickness. A minimum of two loose mix samples per mix per day should be taken at the plant and delivered to the quality-assurance firm's laboratory for vacuum extraction-gradations. The asphalt contractor should provide a minimum of two (2) theoretical maximum density verifications per day.

Compaction Testing should be performed by technicians supervised by a registered geotechnical engineer. Proof rolling and stabilization should be performed by a senior technician or field engineer under the supervision of a registered geotechnical engineer.



General Conditions & Reliance

The report was prepared in accordance with generally accepted practices of the geotechnical engineering profession. The scope of work consisted of performing eight test borings and providing soil related recommendations for the design and construction of the proposed building addition, building and pavement. The scope of work did not include an environmental study or wetland determination.

The report and the associated test borings were prepared specifically for the previously described project and site. Soils & Structures should be consulted if a significant change in the scope of the project is made.

The test borings represent point information and may not have encountered all of the soil types and materials present on this site. This report does not constitute a guarantee of the soil or groundwater conditions or that the test boring is an exact representation of the soil or groundwater conditions at all points on this site.

The descriptions and recommendations contained in this report are based on an interpretation of the test borings and laboratory tests. The test borings should not be used independently of the report. If soil conditions are encountered which are significantly different from the test borings, Soils & Structures should be consulted for additional recommendations.

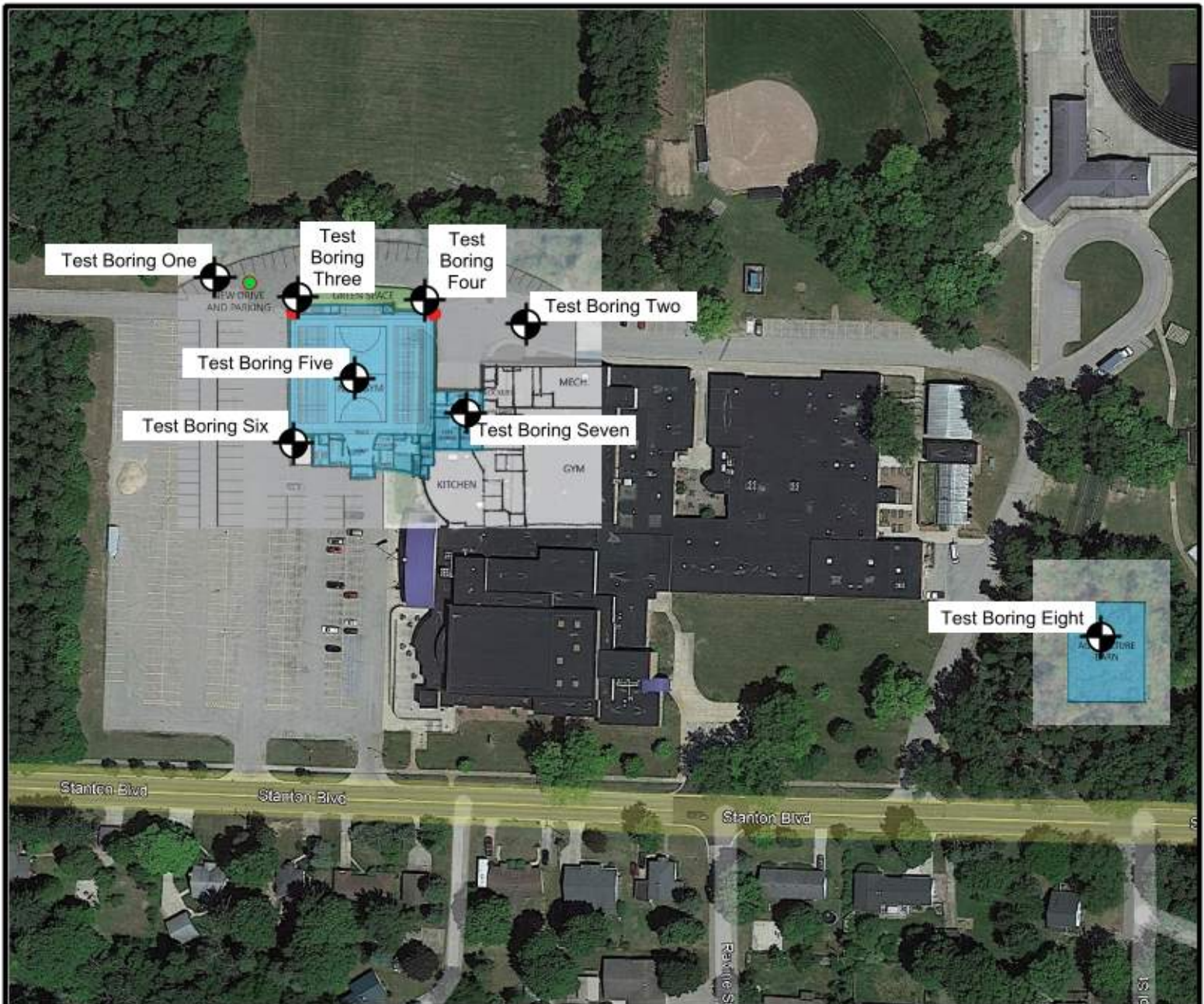
The report and test borings may be relied upon by Montague Area Public Schools for the design, construction, permitting and financing associated with the construction of the Montague Area Public Schools Additions project in Montague, Muskegon County, Michigan. The use of the report and test borings by third parties not associated with this project or for other sites has not been agreed upon by Soils & Structures. Soils & Structures does not recommend or consent to third party use or reliance of the report or test borings unless allowed to review the proposed use of these materials. Unless obtained in writing, consent to third party use should not be assumed. Third parties using the report or test boring logs do so at their own risk and are offered no guarantee or promise of indemnity.



SOILS & STRUCTURES

Appendix

Test Boring Location Plan
General Soil Profile
Test Boring Logs
Laboratory Tests
General Soil Information



VICINITY MAP



SITE

TEST BORING LOCATION PLAN
NTS



Note: The background of the test boring plan is a portion of a site plan over a portion of an aerial photograph from Google Earth dated 6/21/2022

Montague Area Public Schools Addition

Montague, Muskegon County, Michigan

Soils & Structures, Inc.
6480 Grand Haven Road
Muskegon, Michigan 49441

JOB NO: 2022.2109

DATE: 12-13-2022

Project id: 2022.2109

Project Title: Montague Area Public Schools Additions

Location: Montague, Michigan

Client: Montague Area Public Schools

Title:

Section line 1

Vertical Scale:

1:53

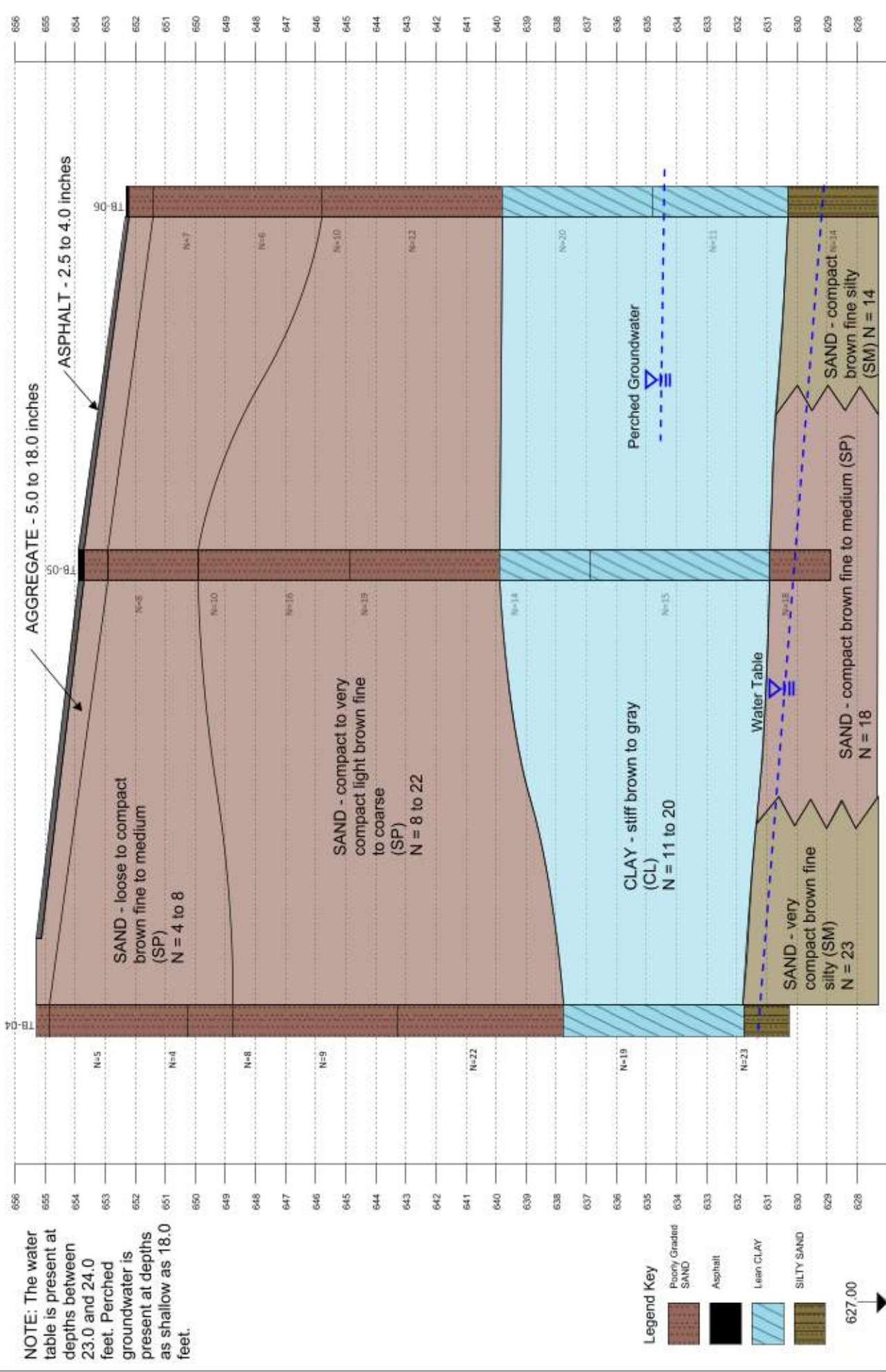
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Engineer:

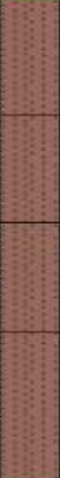
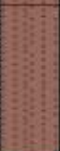
Malcolm Thompson, P.E.

GENERAL SOIL PROFILE





Project Name:	Montague Area Public Schools Additions		Project Number:	2022.2109	
Project Location:	Montague, Michigan		Logged By:	H Scharphorn	Reviewed By: K Martella
Client:	Montague Area Public Schools		Survey Datum:	NAD 1983 StatePlane Michigan South	
Date Started:	Nov 07 2022	Completed:	Nov 07 2022	Northing:	707369.0
Drilling Method:	3-1/4" Hollow Stem Auger		Eastng:	12592631.2	Hole Depth: 15.00
Equipment:	Diedrich D-50		Elevation:	655.04	
Hammer Type:	Automatic Hammer		Ground Water Levels		
Notes:			 End of Drilling Nov 07 2022 - Water Not Encountered		

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits			USCS
											Liquid Limit	Plastic Limit	Plasticity Index	
1		TOPSOIL - dark brown sandy (16.0")												
2		SAND - slightly compact brown fine to medium		SPT-A	67	2-2-3	5			5.0				SP
3														
4		SAND - slightly compact brown fine to medium with a trace of clay and gravel		SPT-B	73	2-2-3	5			5.3			SP	
5														
6		SAND - very compact light brown fine to coarse with a trace of gravel		SPT-C	73	7-9-12	21						SP	
7														
8		SAND - compact light brown fine to medium		SPT-D	67	5-7-12	19			1.9			SP	
9														
10														
11														
12														
13		CLAY - stiff brown with a trace of silt		SPT-E	80	5-8-11	19			21.9				CL
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														



Project Name:	Montague Area Public Schools Additions	Project Number:	2022.2109
Project Location:	Montague, Michigan	Logged By:	H Scharphorn
Client:	Montague Area Public Schools	Reviewed By:	K Martella
Date Started:	Nov 08 2022	Completed:	Nov 08 2022
Drilling Method:	3-1/4" Hollow Stem Auger	Survey Datum:	NAD 1983 StatePlane Michigan South
Equipment:	Diedrich D-50	Hole Depth:	15.00
Hammer Type:	Automatic Hammer	Northing:	707316.6
Notes:		Easting:	12592937.2
		Elevation:	656.74
		Ground Water Levels	
		End of Drilling	Nov 08 2022 - Water Not Encountered

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits			USCS
											Liquid Limit	Plastic Limit	Plasticity Index	
1		ASPHALT - (4.0")												
2		SAND - brown fine to medium gravelly (fill)												
3		SAND - compact brown fine to medium with gravel with a trace of clay	▼	SPT-A	80	5-5-6	11			4.5				SP
4														
5			▼	SPT-B	73	4-4-4	8			4.8				SP
6		GRAVEL - compact brown sandy	▼											
7			▼	SPT-C	20	4-4-7	11			3.6				GP
8														
9			▼											
10			▼	SPT-D	20	4-5-6	11							GP
11		SAND - compact light brown fine to medium												
12														
13			▼	SPT-E	40	6-6-10	16							SP
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														

Project Name: Montague Area Public Schools Additions		Project Number: 2022.2109	
Project Location: Montague, Michigan		Logged By: H Scharphorn	Reviewed By: K Martella
Client: Montague Area Public Schools		Survey Datum: NAD 1983 StatePlane Michigan South	
Date Started: Nov 07 2022	Completed: Nov 07 2022	Northing: 707341.2	Easting: 12592708.9
Drilling Method: 3-1/4" Hollow Stem Auger		Hole Depth: 25.00	
Equipment: Diedrich D-50		Elevation: 653.87	
Hammer Type: Automatic Hammer		Ground Water Levels	
Notes:		At Time of Drilling 19.00 on Nov 07 2022 - Perched Water Encountered	

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits			USCS
											Liquid Limit	Plastic Limit	Plasticity Index	
1		TOPSOIL - dark brown sandy gravelly (12.0")												
2		SAND - slightly compact brown fine to medium with a trace of clay and gravel												
3			▲	SPT-A	67	3-3-4	7			4.2				SP
4			▲											
5		SAND - compact brown fine to coarse with a trace of gravel	▲	SPT-B	47	7-8-10	18							SP
6			▲											
7		SAND - compact light brown fine to medium	▲	SPT-C	73	5-8-11	19			2.8				SP
8		SAND - compact light brown fine to coarse	▲											
9			▲											
10			▲	SPT-D	73	5-7-7	14			2.7				SP
11			▲											
12														
13		CLAY - stiff brown with a trace of silt												
14			▲											
15			▲	SPT-E	80	4-6-10	16		1.06	23.4				CL
16														
17														
18		CLAY - very stiff brown with a trace of silt												
19			▲											
20			▲	SPT-F	0	7-8-14	22							CL
21			▲											
22		CLAY - stiff gray with a trace of silt												
23			▲											
24			▲	SPT-G	80	4-6-9	15			22.0				CL
25														
26														
27														
28														
29														
30														



Project Name:	Montague Area Public Schools Additions		Project Number:	2022.2109	
Project Location:	Montague, Michigan		Logged By:	H Scharphorn	Reviewed By: K Martella
Client:	Montague Area Public Schools		Survey Datum:	NAD 1983 StatePlane Michigan South	
Date Started:	Nov 07 2022	Completed:	Nov 07 2022	Northing:	707334.4
Drilling Method:	3-1/4" Hollow Stem Auger		Eastng:	12592829.9	Hole Depth: 25.00
Equipment:	Diedrich D-50		Ground Water Levels		
Hammer Type:	Automatic Hammer				
Notes:					

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits			USCS				
											Liquid Limit	Plastic Limit	Plasticity Index					
1		SAND - dark brown fine to medium with a trace of gravel (5.0")			67	3-2-3	5			6.0								
2		SAND - slightly compact brown fine to medium																
3			SPT-A															
4																		
5		SAND - loose brown fine to coarse gravelly		SPT-B	47	2-2-2	4											
6																		
7		SAND - compact light brown fine to coarse																
8			SPT-C	60	3-4-4	8												
9																		
10				SPT-D	47	1-4-5	9											
11																		
12			SAND - very compact light brown fine to medium			73	5-9-13			22							3.6	
13																		
14																		
15			SPT-E															
16																		
17																		
18		CLAY - stiff brown with a trace of silt			87	5-8-11	19		2.40	23.9								
19																		
20			SPT-F															
21																		
22																		
23		▼ SAND - very compact brown fine silty			80	5-10-13	23			21.3								
24			SPT-G															
25																		
26																		
27																		
28																		
29																		
30																		



Project Name:	Montague Area Public Schools Additions	Project Number:	2022.2109
Project Location:	Montague, Michigan	Logged By:	H Scharphorn
Client:	Montague Area Public Schools	Reviewed By:	K Martella
Date Started:	Nov 07 2022	Survey Datum:	NAD 1983 StatePlane Michigan South
Completed:	Nov 07 2022	Hole Depth:	25.00
Drilling Method:	3-1/4" Hollow Stem Auger	Northing:	707262.7
Equipment:	Diedrich D-50	Easting:	12592761.0
Hammer Type:	Automatic Hammer	Elevation:	653.89
Notes:	Ground Water Levels End of Drilling 24.00 on Nov 07 2022		

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits			USCS
											Liquid Limit	Plastic Limit	Plasticity Index	
1		ASPHALT - (3.0")												
		SAND - brown fine to medium gravelly (9.0") (fill)												
2		SAND - compact brown fine to medium												
3			▲	SPT-A	73	3-4-4	8			4.0				SP
4														
5		SAND - compact brown fine to coarse with gravel	▲	SPT-B	73	2-3-7	10							SP
6			▲											
7				▲										
8				▲	SPT-C	80	5-6-10	16						SP
9														
10		SAND - compact light brown fine to medium with a trace of gravel	▲	SPT-D	73	5-9-10	19			2.4				SP
11			▲											
12														
13														
14		CLAY - stiff brown with a trace of silt	▲	SPT-E	60	3-5-9	14							CL
15														
16														
17		CLAY - stiff gray silty with lenses of sand												
18														
19														
20			▲	SPT-F	87	5-6-9	15			19.6				CL
21			▲											
22														
23														
24		SAND - compact brown fine to medium	▲	SPT-G	73	3-5-13	18			21.1				SP
25			▲											
26														
27														
28														
29														
30														



Project Name:	Montague Area Public Schools Additions	Project Number:	2022.2109
Project Location:	Montague, Michigan	Logged By:	H Scharphorn
Client:	Montague Area Public Schools	Reviewed By:	K Martella
Date Started:	Nov 07 2022	Survey Datum:	NAD 1983 StatePlane Michigan South
Completed:	Nov 07 2022	Hole Depth:	25.00
Drilling Method:	3-1/4" Hollow Stem Auger	Northing:	707211.8
Equipment:	Diedrich D-50	Easting:	12592700.1
Hammer Type:	Automatic Hammer	Elevation:	652.30
Notes:	Ground Water Levels At Time of Drilling 18.00 on Nov 07 2022 - Perched Water Encountered End of Drilling 23.00 on Nov 07 2022		

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits			USCS
											Liquid Limit	Plastic Limit	Plasticity Index	
1		ASPHALT - (2.5")												
2		SAND - brown fine to medium gravelly (8.5") (fill)												
3		SAND - slightly compact brown fine to medium		SPT-A	80	4-3-4	7			3.8				SP
4														
5				SPT-B	73	3-3-3	6			4.0				SP
6														
7		SAND - compact light brown fine to medium		SPT-C	80	3-4-6	10							SP
8														
9				SPT-D	67	2-5-7	12			2.7				SP
10														
11														
12														
13		CLAY - stiff brown with a trace of silt												
14														
15			SPT-E	80	5-8-12	20		2.79	19.7				CL	
16														
17														
18		CLAY - stiff brown with silt with lenses of silt												
19														
20			SPT-F	80	3-4-7	11			22.3				CL	
21														
22		SAND - compact brown fine silty												
23			SPT-G	80	5-6-8	14			27.4				SM	
24														
25														
26														
27														
28														
29														
30														

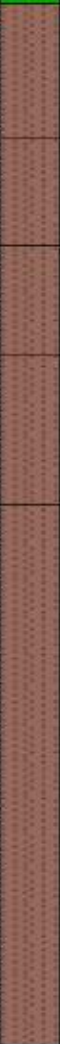


Project Name:	Montague Area Public Schools Additions	Project Number:	2022.2109
Project Location:	Montague, Michigan	Logged By:	H Scharphorn
Client:	Montague Area Public Schools	Reviewed By:	K Martella
Date Started:	Nov 08 2022	Survey Datum:	NAD 1983 StatePlane Michigan South
Completed:	Nov 08 2022	Hole Depth:	25.00
Drilling Method:	3-1/4" Hollow Stem Auger	Northing:	707226.4
Equipment:	Diedrich D-50	Easting:	12592886.0
Hammer Type:	Automatic Hammer	Elevation:	658.16
Notes:	Ground Water Levels End of Drilling Nov 08 2022 - Water Not Encountered		

Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits				USCS
											Liquid Limit	Plastic Limit	Plasticity Index		
1		CONCRETE - (6.25")		SPT-A	73	6-6-6	12								SP
2		SAND - compact brown fine to medium (possible fill)													
3															
4			SAND - loose brown fine to medium with silt with a trace of gravel		SPT-B	80	3-2-2	4							SP
5															
6															
7			SAND - slightly compact brown fine to medium with a trace of clay and gravel		SPT-C	80	2-2-3	5							SP
8			SAND - compact brown fine to coarse with a trace of clay and gravel												
9															
10					SPT-D	60	2-3-5	8							SP
11															
12															
13		SAND - slightly compact light brown fine to medium		SPT-E	73	2-2-3	5							SP	
14															
15															
16		SAND - slightly compact light brown fine to medium with a trace of gravel		SPT-F	60	4-3-2	5							SP	
17															
18															
19		SAND - compact light brown fine to medium		SPT-G	73	5-7-10	17							SP	
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															



Project Name:	Montague Area Public Schools Additions	Project Number:	2022.2109
Project Location:	Montague, Michigan	Logged By:	H Scharphorn
Client:	Montague Area Public Schools	Reviewed By:	K Martella
Date Started:	Nov 08 2022	Survey Datum:	NAD 1983 StatePlane Michigan South
Completed:	Nov 08 2022	Hole Depth:	25.00
Drilling Method:	3-1/4" Hollow Stem Auger	Northing:	706985.9
Equipment:	Diedrich D-50	Eastng:	12593506.9
Hammer Type:	Automatic Hammer	Elevation:	663.85
Notes:	Ground Water Levels Nov 08 2022 - Water Not Encountered		

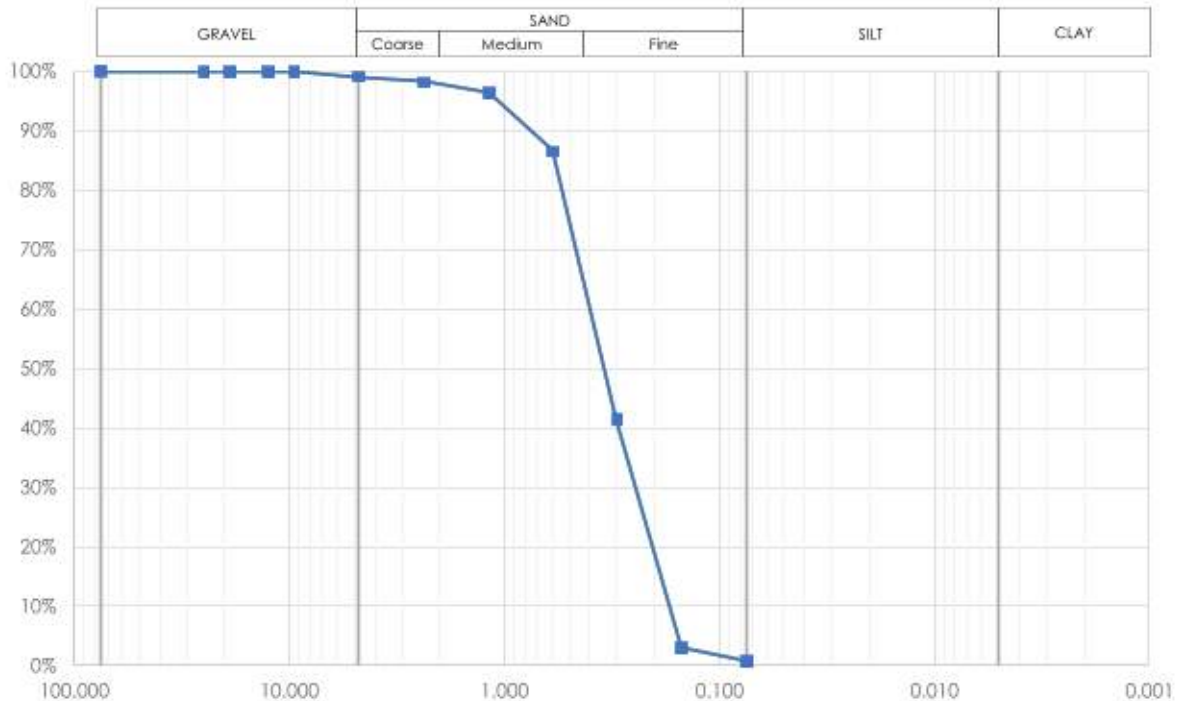
Depth	Graphic	Material Description	Sample Type	Number	Recovery % RQD	Blow Counts	N-Value	Pocket Pen (tsf)	Shear Strength (tsf)	Moisture Content (%)	Atterberg Limits				USCS
											Liquid Limit	Plastic Limit	Plasticity Index		
1		TOPSOIL - dark brown sandy (11.0")													
2		SAND - loose brown fine to medium													
3															
4															
5		SAND - slightly compact brown fine to medium													
6															
7		SAND - compact light brown fine to coarse gravelly													
8															
9															
10		SAND - compact light brown fine to coarse with gravel													
11															
12															
13		SAND - compact light brown fine to medium													
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															



SOILS & STRUCTURES

Particle Size Distribution Report

Project Name Montague Area Public Schools Additions
 Project Number 2022.2109
 Client Montague Area Public Schools
 Date 11/17/2022
 Sample Location TB-01 Sample ID A Depth (ft) 2.0



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0%	0.0%	0.9%	1.4%	37.4%	59.4%	0.0%	0.0%
D85	D60	D50	D30	D15	D10	Loss By Wash	
0.5893	0.4230	0.3564	0.2550	0.1964	0.1769	0.9%	

Particle Size		Hydrometer		Material Description
Sieve	% Passing	Particle Size (mm)	% Passing	Fine to Medium SAND (SP)
3 in.	100%			
1 in.	100%			
3/4 in.	100%			
1/2 in.	100%			
3/8 in.	100%			
No. 4	99%			
No. 8	98%			
No. 16	96%			
No. 30	87%			
No. 50	42%			
No. 100	3%			Remarks
No. 200	0.9%			

Technician

Checked
mvanweelden

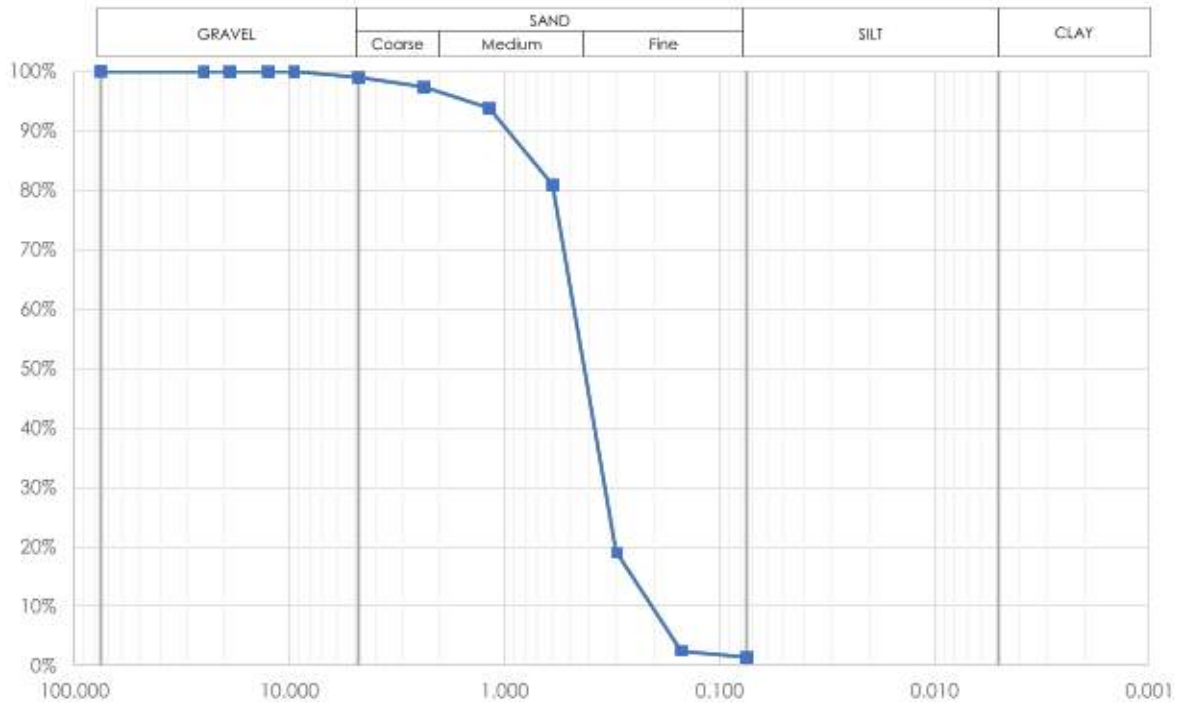
Approved
mvanweelden



SOILS & STRUCTURES

Particle Size Distribution Report

Project Name Montague Area Public Schools Additions
 Project Number 2022.2109
 Client Montague Area Public Schools
 Date 11/17/2022
 Sample Location TB-05 Sample ID A Depth (ft) 2.0



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0%	0.0%	1.1%	2.6%	51.5%	43.4%	0.0%	0.0%
D85	D60	D50	D30	D15	D10	Loss By Wash	
0.7831	0.4985	0.4500	0.3531	0.2632	0.2177	1.5%	

Particle Size		Hydrometer		Material Description
Sieve	% Passing	Particle Size (mm)	% Passing	Fine to Medium SAND (SP)
3 in.	100%			
1 in.	100%			
3/4 in.	100%			
1/2 in.	100%			
3/8 in.	100%			
No. 4	99%			
No. 8	97%			
No. 16	94%			
No. 30	81%			
No. 50	19%			
No. 100	3%			Remarks
No. 200	1.5%			

Technician

Checked
mvanweelden

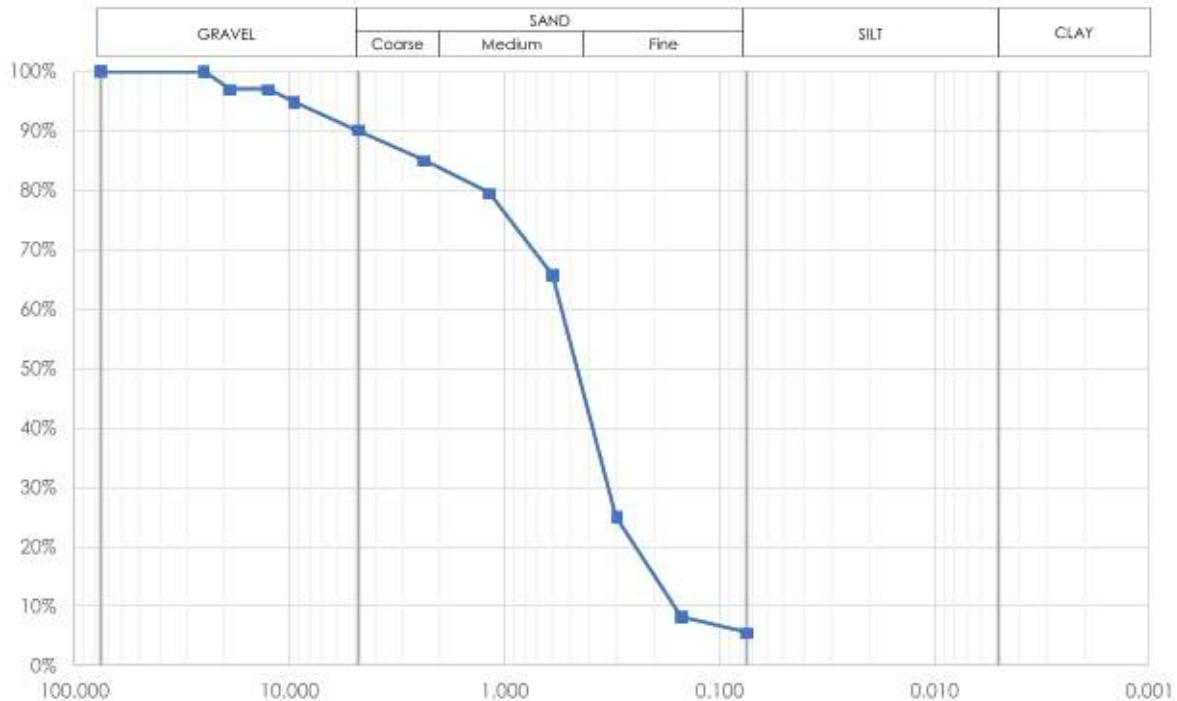
Approved
mvanweelden



SOILS & STRUCTURES

Particle Size Distribution Report

Project Name Montague Area Public Schools Additions
 Project Number 2022.2109
 Client Montague Area Public Schools
 Date 11/17/2022
 Sample Location TB-02 Sample ID B Depth (ft) 4.5



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0%	3.1%	6.8%	6.8%	41.3%	36.5%	0.0%	0.0%
D85	D60	D50	D30	D15	D10	Loss By Wash	
2.3919	0.5576	0.4840	0.3368	0.2106	0.1659	5.1%	

Particle Size		Hydrometer		Material Description
Sieve	% Passing	Particle Size (mm)	% Passing	Fine to Medium SAND with Gravel and a Trace of Clay (SP)
3 in.	100%			
1 in.	100%			
3/4 in.	97%			
1/2 in.	97%			
3/8 in.	95%			
No. 4	90%			
No. 8	85%			
No. 16	79%			
No. 30	66%			
No. 50	25%			
No. 100	8%			Remarks
No. 200	5.5%			

Technician

Checked
mvanweelden

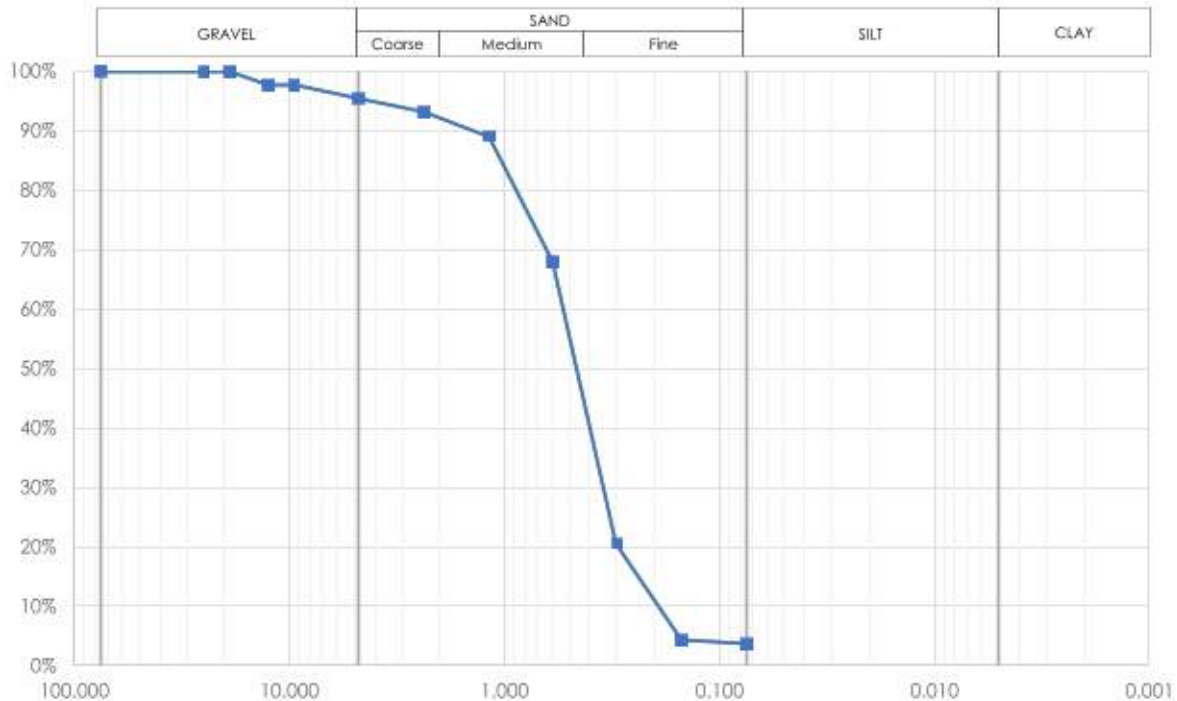
Approved
mvanweelden



SOILS & STRUCTURES

Particle Size Distribution Report

Project Name Montague Area Public Schools Additions
 Project Number 2022.2109
 Client Montague Area Public Schools
 Date 11/17/2022
 Sample Location TB-06 Sample ID B Depth (ft) 4.5



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0%	0.0%	4.5%	3.7%	51.5%	36.7%	0.0%	0.0%
D85	D60	D50	D30	D15	D10	Loss By Wash	
1.0679	0.5492	0.4859	0.3592	0.2477	0.2014	3.6%	

Particle Size		Hydrometer		Material Description
Sieve	% Passing	Particle Size (mm)	% Passing	Fine to Medium SAND (SP)
3 in.	100%			
1 in.	100%			
3/4 in.	100%			
1/2 in.	98%			
3/8 in.	98%			
No. 4	96%			
No. 8	93%			
No. 16	89%			
No. 30	68%			
No. 50	21%			
No. 100	4%			Remarks
No. 200	3.6%			

Technician

Checked
mvanweelden

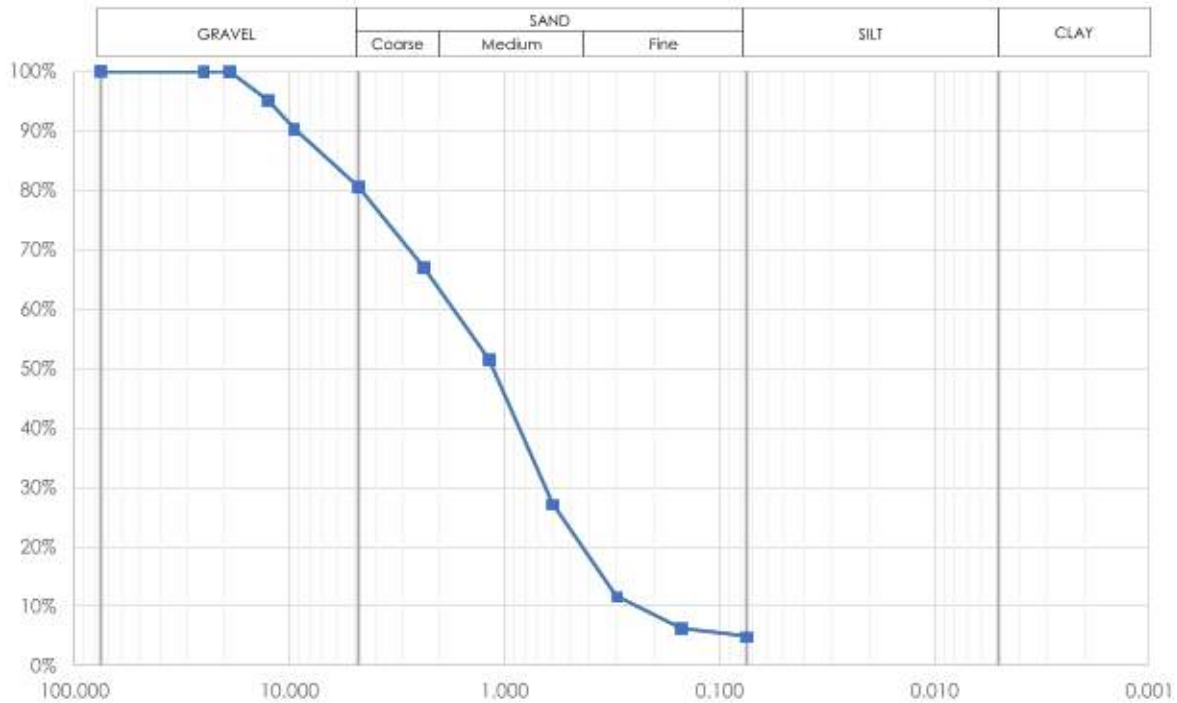
Approved
mvanweelden



SOILS & STRUCTURES

Particle Size Distribution Report

Project Name Montague Area Public Schools Additions
 Project Number 2022.2109
 Client Montague Area Public Schools
 Date 11/17/2022
 Sample Location TB-04 Sample ID B Depth (ft) 4.5



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0%	0.0%	19.4%	18.3%	44.1%	13.3%	0.0%	0.0%
D85	D60	D50	D30	D15	D10	Loss By Wash	
6.9113	1.8290	1.1452	0.6673	0.3647	0.2536	4.9%	

Particle Size		Hydrometer		Material Description
Sieve	% Passing	Particle Size (mm)	% Passing	Fine to Coarse Gravelly SAND (SP)
3 in.	100%			
1 in.	100%			
3/4 in.	100%			
1/2 in.	95%			
3/8 in.	90%			
No. 4	81%			
No. 8	67%			
No. 16	51%			
No. 30	27%			
No. 50	12%			
No. 100	6%			Remarks
No. 200	4.9%			

Technician

Checked
mvanweelden

Approved
mvanweelden



SOILS & STRUCTURES

Particle Size Distribution Report

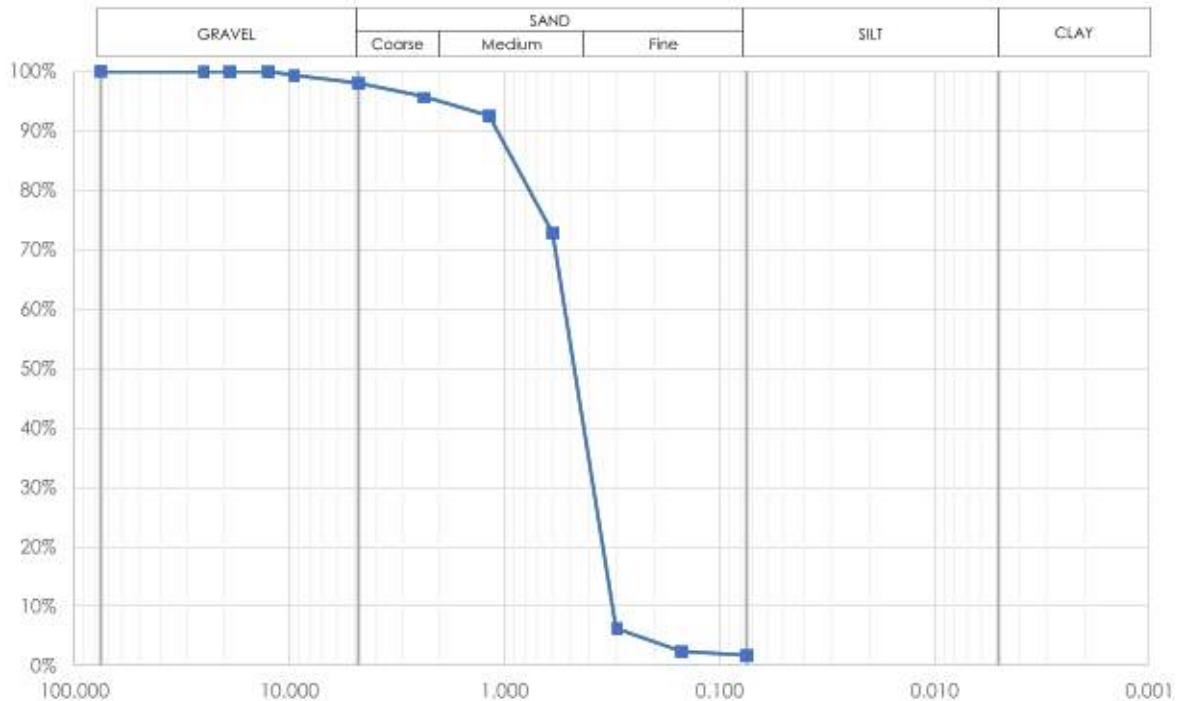
Project Name Montague Area Public Schools Additions

Project Number 2022.2109

Client Montague Area Public Schools

Date 11/17/2022

Sample Location TB-03 Sample ID C Depth (ft) 7.0



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0%	0.0%	2.0%	3.3%	60.7%	32.4%	0.0%	0.0%
D85	D60	D50	D30	D15	D10	Loss By Wash	
0.9583	0.5424	0.4972	0.4068	0.3389	0.3163	1.7%	

Particle Size		Hydrometer		Material Description
Sieve	% Passing	Particle Size (mm)	% Passing	Fine to Medium SAND (SP)
3 in.	100%			
1 in.	100%			
3/4 in.	100%			
1/2 in.	100%			
3/8 in.	99%			
No. 4	98%			
No. 8	96%			
No. 16	93%			
No. 30	73%			
No. 50	6%			Remarks
No. 100	2%			
No. 200	1.7%			

Technician

Checked
mvanweelden

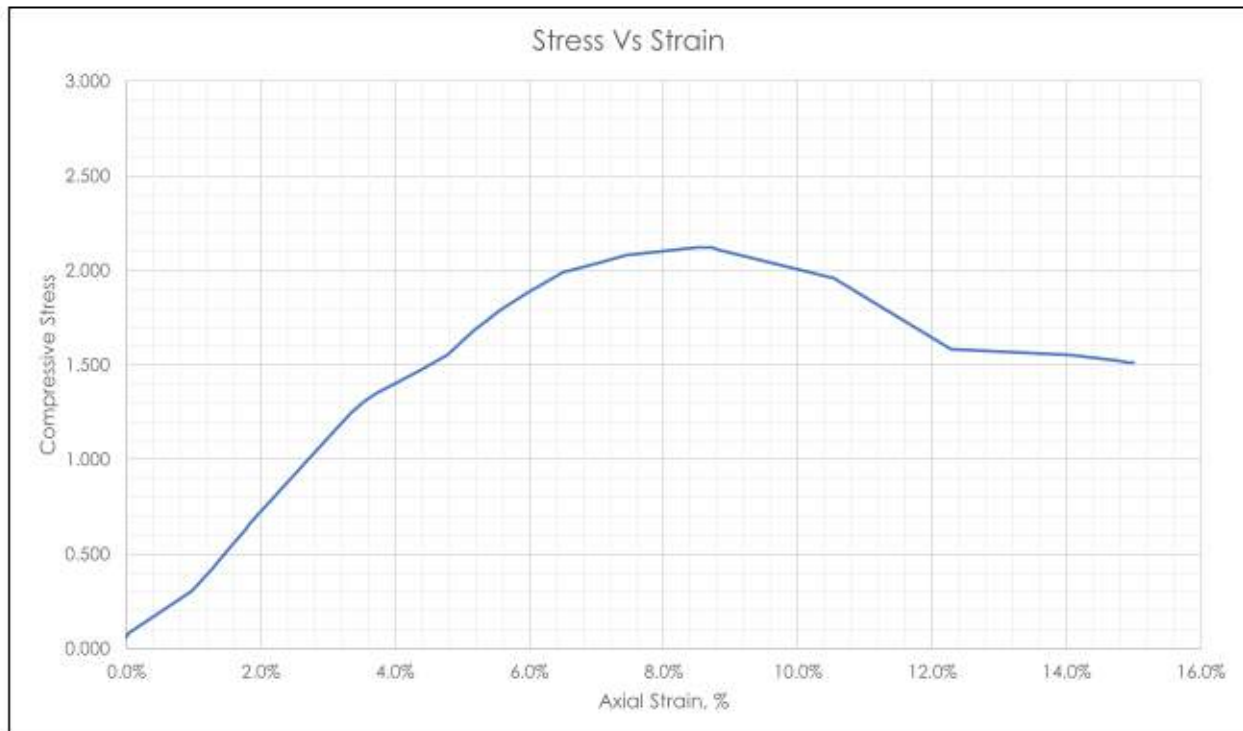
Approved
mvanweelden



Unconfined Compressive Strength

Project Name Montague Area Public Schools Additions
 Project Number 2022.2109
 Date 11/17/2022
 Client Montague Area Public Schools
 Sample Location TB-03 Sample ID E

Depth (ft) 14.5



Sample ID	E
Unconfined Strength (tsf)	2.122
Undrained Shear Strength (tsf)	1.061
Failure Strain (%)	8.5%
Strain Rate, (in/min)	0.055
Moisture Content	23.1%
Wet Density (pcf)	121.5
Dry Density (pcf)	98.7
Void Ratio	0.6946
Saturation (%)	89.1%
Specimen Diameter (in)	1.47
Specimen Height (in)	2.89
Height/Diameter Ratio	1.97

Liquid Limit

Plastic Limit

Plasticity Index

Assumed GS
2.68

Remarks

Technician

Checked
mvanweelden

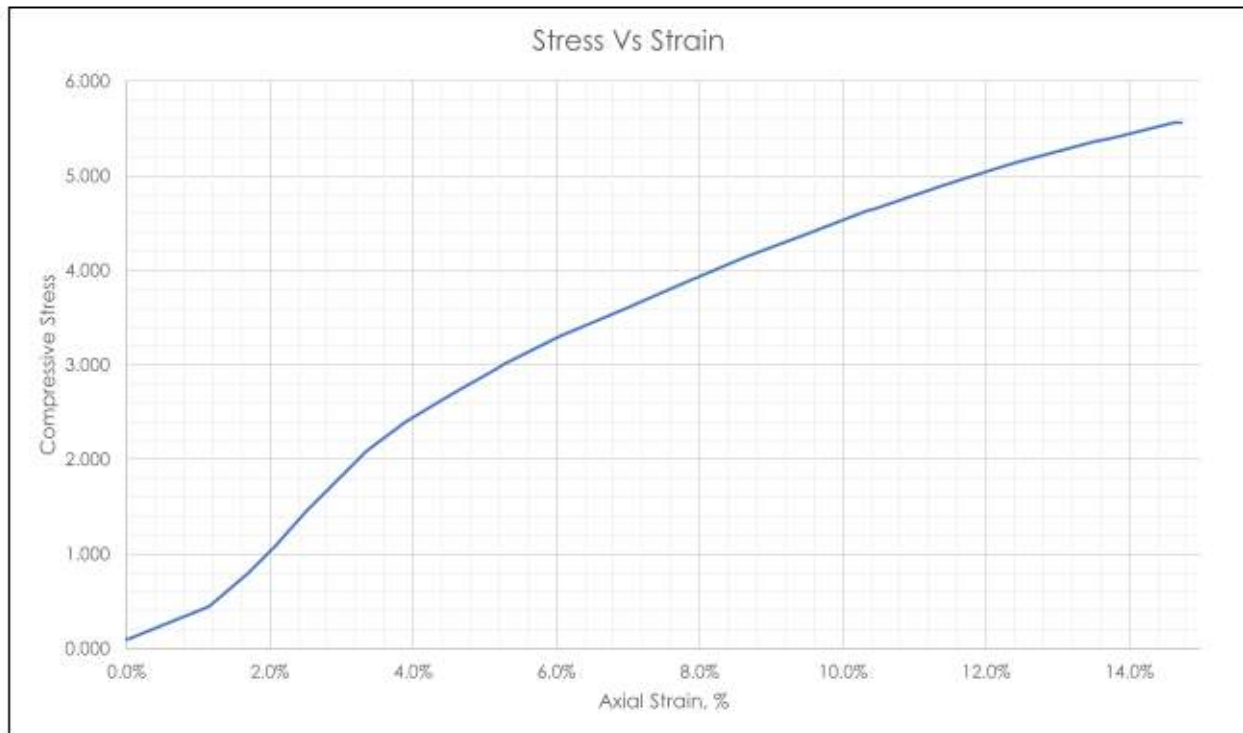
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mvanweelden



Unconfined Compressive Strength

Project Name Montague Area Public Schools Additions
Project Number 2022.2109
Date 11/17/2022
Client Montague Area Public Schools
Sample Location TB-06 Sample ID E

Depth (ft) 14.5



Sample ID	E
Unconfined Strength (tsf)	5.571
Undrained Shear Strength (tsf)	2.786
Failure Strain (%)	14.7%
Strain Rate, (in/min)	0.055
Moisture Content	19.7%
Wet Density (pcf)	130.2
Dry Density (pcf)	108.7
Void Ratio	0.5379
Saturation (%)	98.3%
Specimen Diameter (in)	1.37
Specimen Height (in)	2.95
Height/Diameter Ratio	2.15

Liquid Limit

Plastic Limit

Plasticity Index

Assumed GS
2.68

Remarks

Technician

Checked
mvanweelden

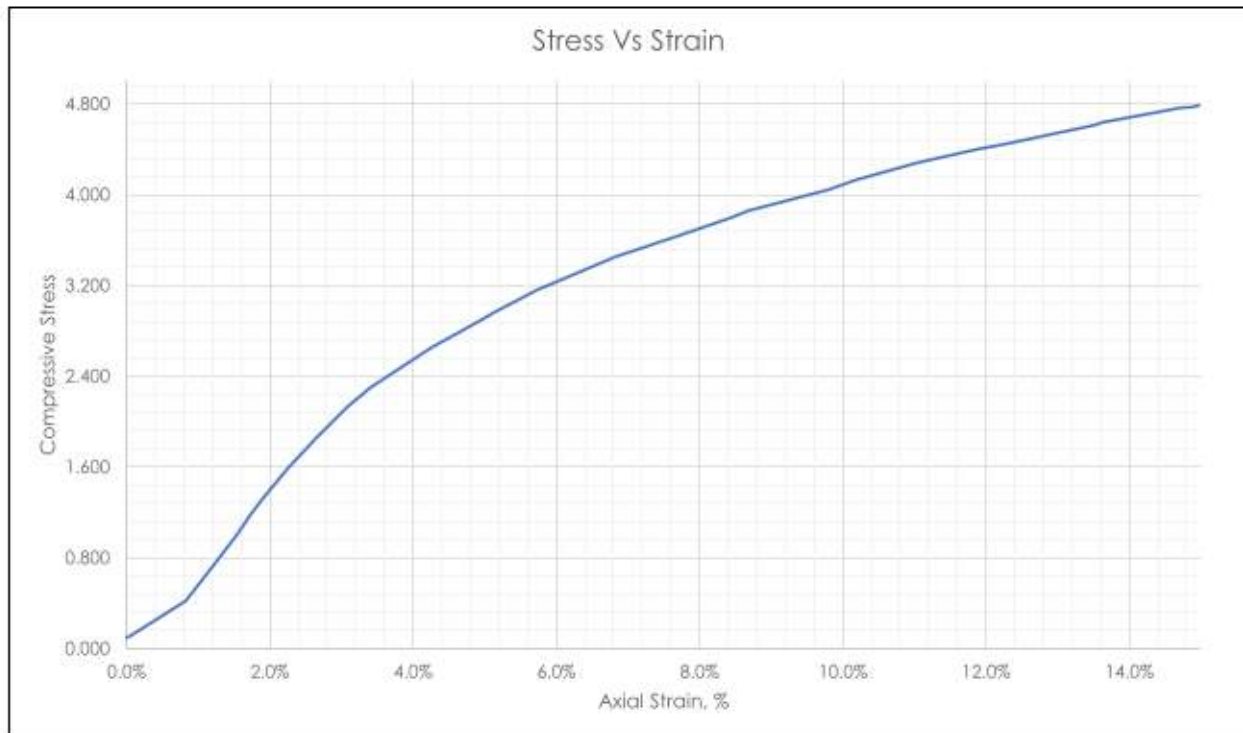
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mvanweelden



Unconfined Compressive Strength

Project Name Montague Area Public Schools Additions
Project Number 2022.2109
Date 11/17/2022
Client Montague Area Public Schools
Sample Location TB-04 Sample ID F

Depth (ft) 19.5



Sample ID	F
Unconfined Strength (tsf)	4.795
Undrained Shear Strength (tsf)	2.397
Failure Strain (%)	15.0%
Strain Rate, (in/min)	0.055
Moisture Content	23.9%
Wet Density (pcf)	125.4
Dry Density (pcf)	101.3
Void Ratio	0.6516
Saturation (%)	98.3%
Specimen Diameter (in)	1.38
Specimen Height (in)	3.01
Height/Diameter Ratio	2.18

Liquid Limit

Plastic Limit

Plasticity Index

Assumed GS
2.68

Remarks

Technician

Checked
mvanweelden

Approved
mvanweelden

General Information for Method of Field Investigation

The soil investigation was performed in accordance with the American Society of Testing and Materials method ASTM D 1586, which is the "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils". Samples of compressible clays or organic soils are obtained in accordance with ASTM D 1587, which is the "Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes." Rock may be cored in conjunction with the above methods as specified in ASTM D 2113 which is the "Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation."

Field Testing

Standard Penetration Tests (SPT) in accordance with ASTM D 1586 were generally performed at depths of 2.0', 4.5', 7.0', 9.5' and 5.0' intervals thereafter.

Laboratory Testing

Samples obtained from the Standard Penetration Test, ASTM D 1586 or thin walled tube method, ASTM D 1587, were tested in the laboratory for the moisture content and density and/or particle size, where applicable. When soils sampled possessed sufficient cohesive properties, it was tested for its compressive strength in the unconfined state.

Natural Percent Moisture content (N.P.M.) of the soil is the percentage by weight of water contained in the soil sample compared to the dry weight of the solids of which the soil is composed. The NPM of select samples is determined in accordance with ASTM D 2216.

Natural Density (N.D.) of soil as reported on the appended boring logs is the natural wet density of the soils expressed in pounds per cubic foot.

The unconfined compressive strength of cohesive soils is determined in the laboratory on "undisturbed" select samples in accordance with ASTM D 2166. This test determines the maximum load required at a specified rate to deform the cohesive soil specimen length twenty (20%) percent. The primary purpose of the unconfined compression test is to obtain approximate quantitative values of the compressive strength of soils possessing sufficient coherence to permit testing in the unconfined state. The shear strength of the cohesive soil can be calculated from the results of the unconfined compressive strength test.

Color

When the color of the soils is uniform throughout, the color recorded will be such as brown, gray, and black and may be modified by adjectives such as light and dark. If the soils predominant color is shaded by secondary color, the secondary color precedes the primary color, such as gray-brown, or yellow-brown. If two major and distinct colors are swirled throughout the soil, the colors will be modified by the term mottled; such as mottled brown and gray.

Water Observations

Depth of water recorded in the test boring is measured from the ground surface to the water surface. Initial depth indicates water level during boring, completing depth indicates water level immediately after boring, and depth after "X" number of hours indicates water level after allowing the groundwater rise or fall over a period of time. Water observations in pervious soils are considered reliable groundwater levels for accurate groundwater measurements at the time the test borings were performed unless records are made over several days' time. Factors such as weather, soils porosity, etc., will cause the groundwater level to fluctuate for both pervious and impervious soils.

Sample Type

If not otherwise indicated, the sample is a split-barrel liner sample ASTM D 1586.

"S.T." – Shelby tube sample, ASTM D 1587
"A" – disturbed augered sample
"C" – rock core sampled ASTM D 2113
N.P.M. – Natural Percent Moisture of in-situ soils sample
N.D. – Natural Density of in-situ soils sample in pcf.
S.S. – Shear Strength of cohesive soils samples as determined by the Unconfined Compression tests in ksf.

Classification Data – Laboratory data to assist in classification of soils and classification of soils characteristics; i.e., plastic limit or liquid limit

Test Boring Logs

Particle Size	Visual
Boulders	Larger than 12" (300 mm)
Cobbles	12" to 3" (300 to 75 mm)
Gravel - Coarse	3" to ¾" (75 to 19 mm)
Gravel - Fine	19.0 to 4.75 mm
Sand - Coarse	4.75 to 2.0 mm
Sand - Medium	2.0 to 0.425 mm
Sand - Fine	0.425 to 0.075 mm
Silt	0.075 to 0.002 mm
Clay	0.002 mm and smaller

Soils Components

Major Component	Minor Component
Gravel	Trace (1 - 10%)
Sand	Some (11 - 35%)
Silt/Clay	And (36 - 50%)

Condition of Soil Relative to Compactness

Granular Material	"N" Value
Loose	0 - 4
Slightly Compact	5 - 7
Compact	8 - 20
Very Compact	21 - 50
Extremely Compact	51 and above

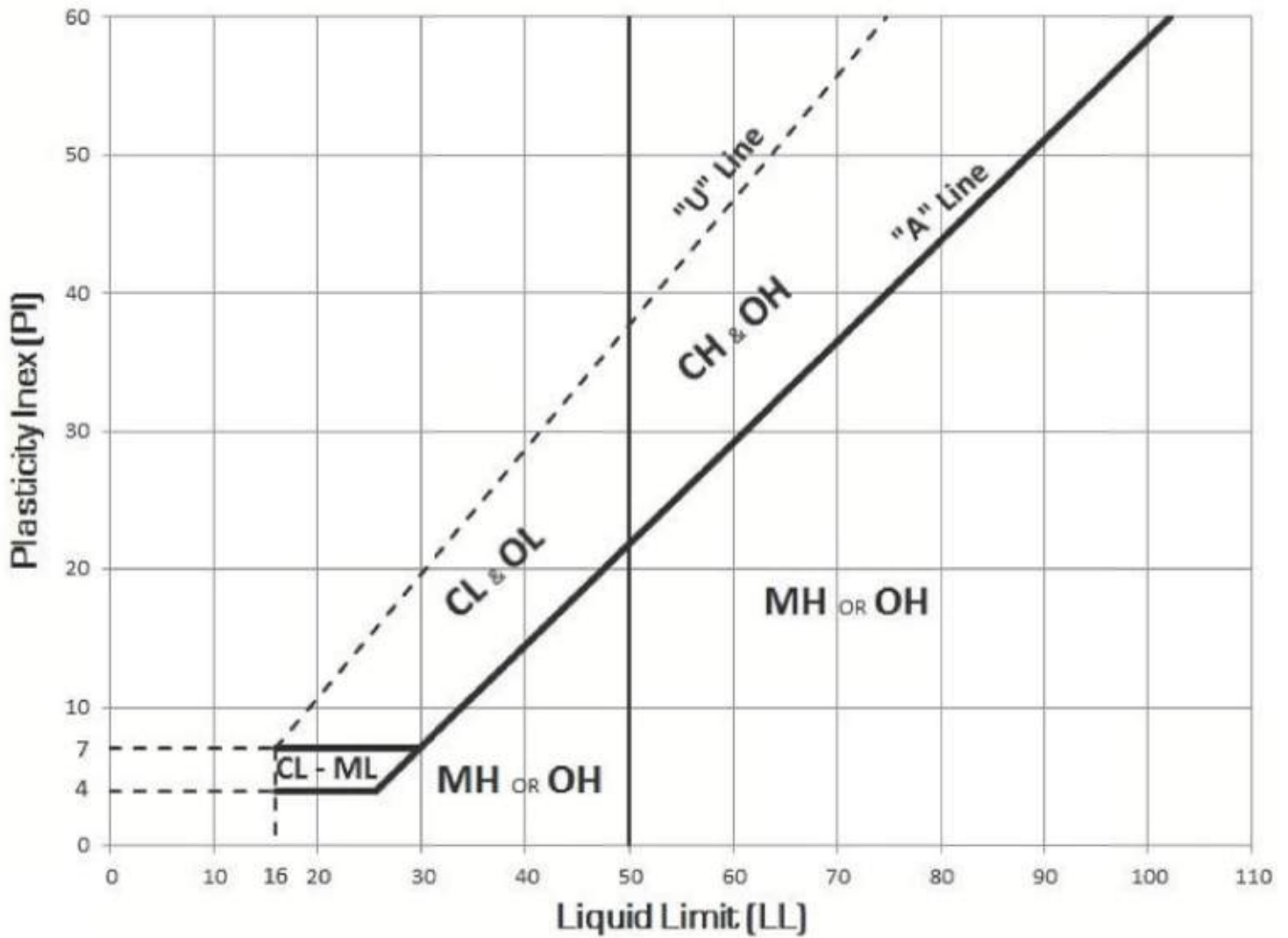
Cohesive Material	"N" Value
Soft	0 - 4
Firm	5 - 7
Stiff	8 - 20
Very Stiff	21 - 50
Extremely Stiff	51 and above

"N" values in clay soils are not to be used as a measure of shear strength. However, they may be used as a general indication of strength.

Unified Soil Classification System Chart

Major Divisions			Letter Symbol	Typical Descriptions	
Coarse Grained Soils	Gravel – Gravelly Soils	Clean gravels (little or no fines)	GW	Well-Graded gravels, gravel-sand mixtures, little or no fines	
			GP	Poorly-Graded gravels, gravel-sand mixtures, little or no fines	
		more than 50% of coarse fraction retained on No. 4 sieve	Gravel with Fines (appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures
				GC	Clayey gravels, gravel-sand-clay mixtures
	Sand and Sandy Soils	Clean Sand (little or no fines)	SW	Well-Graded sands, gravelly sands, little or no fines	
			SP	Poorly-Graded sands, gravelly sands, little or no fines	
		More than 50% of coarse fraction passing No. 4 sieve	Sand with Fines (appreciable amount of fines)	SM	Silty sands, sand-silt mixtures
				SC	Clayey sands, sand-clay mixtures
Fine Grained Soils	Silts and Clays	Liquid limit less than 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
			CL	Inorganic clays or low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silty clays or low plasticity	
	Silts and Clays	Liquid limit greater than 50	MH	Inorganic silts, micaceous or diatomaceous fine sand or silty soils	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays or medium to high plasticity, organic silts	
		Highly organic soils	PT	Peat, humus, swamp soils with high organic contents	

For Laboratory Classification of Fine Grained Soil Plasticity Chart



SECTION 00 4325 - SUBSTITUTION DURING PROCUREMENT REQUEST FORM

1.1 INTRODUCTORY INFORMATION

- A. Date: _____
- B. Requesting substitution of _____
- C. As specified in Section _____
- D. Requested Substitute Product: _____

1.2 SUBMITTING PARTY'S STATEMENT

- A. Circle "Y" for yes and "N" for no for each of the following statements and submit supporting data. Indicate impact for all statements below answered as no, with supporting data:
1. (Y) (N) Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 2. (Y) (N) Requested substitution does not require extensive revisions to the Contract Documents.
 3. (Y) (N) Requested substitution is consistent with the Contract Documents and will produce indicated results.
 4. (Y) (N) Substitution request is fully documented and properly submitted in accordance with "Product Substitution" and "Submittals" Articles in Division 01 Section "Product Requirements."
 5. (Y) (N) Requested substitution will not adversely affect Contractor's Construction Schedule.
 6. (Y) (N) Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. (Y) (N) Requested substitution is compatible with other portions of the Work.
 8. (Y) (N) Requested substitution has been coordinated with other portions of the Work.
 9. (Y) (N) Requested substitution provides specified warranty.
- B. I hereby certify that the above statements are true.

Submitter's signature

END OF DOCUMENT 00 4325

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SECTION 00 6324 - BIM TRANSFER WAIVER

INTENT

- A. This document amends and supplements the Digital Data Licensing Agreement AIA C106 - 2013 for requests for BIM Model from the Architect. All provisions which are not so amended or supplemented remain in full force and effect.
- B. At the request of the Contractor, subcontractor, lower-tier subcontractor, or material supplier, and receipt of signed copy of Digital Data Licensing Agreement AIA C106, the Architect will transmit or send BIM model(s) requested.
- C. The Receiving Party (Construction Manager, Contractor, subcontractor, lower-tier subcontractor, or material supplier) shall send a request to the Architect to draft the Agreement. Include in the request the Receiving Party name and mailing address and the drawing sheet numbers that are requested. Architect will draft the Agreement and send to the Receiving Party for signature.

D. MODIFICATIONS TO AIA C106

E. ARTICLE 3 – LICENSE CONDITIONS

- F. Add the following clauses after the first sentence in Article 3:
 - 1. We make no representation as to the compatibility of these files with your hardware or your software beyond the specified release of the referenced specifications.
 - 2. Data contained on these electronic files are part of our instruments of service and shall not be used by you or anyone else receiving this data through or from you for any purpose other than as a convenience in the support of construction coordination for the referenced project. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to Tower Pinkster Titus Associates. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against us, our officers, directors, employees, agents or subconsultants that may arise out of or in connection with your use of the electronic files.
 - 3. Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold us harmless against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising out of or resulting from your use of these electronic files.
 - 4. These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. We make no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the hard-copy construction documents prepared by us and the electronic files, the hard-copy construction documents shall govern. You are responsible for determining if any conflict exists. By your use of these electronic files, you are not relieved of your duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project.
 - 5. Because information presented on the electronic files can be modified, unintentionally or otherwise, we reserve the right to remove all indicia of ownership and/or involvement from each electronic display.

PROJECT NO. 22-136.03
MONTAGUE APS - AGRICULTURAL CLASSROOM AND BARN
MONTAGUE AREA PUBLIC SCHOOLS

BIM TRANSFER WAIVER
00 6324 - 2
JUNE 30, 2026

END OF DOCUMENT 00 6324

SECTION 00 6325 - SUBSTITUTION DURING CONSTRUCTION REQUEST FORM

1.1 INTRODUCTORY INFORMATION

- A. Date: _____
- B. Requesting substitution of _____
- C. As specified in Section _____
- D. Requested Substitute Product: _____

1.2 SUBMITTING PARTY'S STATEMENT

- A. Circle "Y" for yes and "N" for no for each of the following statements and submit supporting data. Indicate impact for all statements below answered as no, with supporting data:
1. (Y) (N) Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 2. (Y) (N) Requested substitution does not require extensive revisions to the Contract Documents.
 3. (Y) (N) Requested substitution is consistent with the Contract Documents and will produce indicated results.
 4. (Y) (N) Substitution request is fully documented and properly submitted in accordance with "Product Substitution" and "Submittals" Articles in Division 01 Section "Product Requirements."
 5. (Y) (N) Requested substitution will not adversely affect Contractor's Construction Schedule.
 6. (Y) (N) Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. (Y) (N) Requested substitution is compatible with other portions of the Work.
 8. (Y) (N) Requested substitution has been coordinated with other portions of the Work.
 9. (Y) (N) Requested substitution provides specified warranty.
- B. I hereby certify that the above statements are true.

Submitter's signature

1.3 CONTRACTOR'S STATEMENT

- A. I have reviewed this substitution request and am in agreement with the information presented and statements made. This proposal is complete, and there will be no further charges to the Owner as a result of the acceptance of this substitution.

Contractor's signature

END OF DOCUMENT 00 6325

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Document 00 2600 "Procurement Substitution Procedures" for requirements for substitution requests prior to award of Contract.
 - 2. Section 01 6000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - a. Unavailability due to failure to procure products in a timely manner does not constitute substitution for cause, and will be considered as substitution for convenience.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form provided in Project Manual.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities

- may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

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

1.5 PROCEDURES

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

1.6 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed **unless otherwise indicated**.

END OF SECTION 01 2500

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SECTION 01 2600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 01 2500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue through Construction Manager supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.3 PROPOSAL REQUESTS

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

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 01 2500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 01 2100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 01 2200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701CMA.

1.6 CONSTRUCTION CHANGE DIRECTIVE

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

END OF SECTION 01 2600

SECTION 01 2900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 01 2600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect through Construction Manager at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Arrange schedule of values consistent with format of AIA Document G703.
 - 2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
 - 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
5. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
6. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
7. Purchase Contractors: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by the contractor.
8. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
9. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and Construction Manager and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application for Payment Forms: Use AIA Document G732 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.

2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Sustainable design action plans, including preliminary project materials cost data.
 6. Schedule of unit prices.
 7. Submittal schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. List of Contractor's principal consultants.
 10. Copies of building permits.
 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 12. Initial progress report.
 13. Report of preconstruction conference.
 14. Certificates of insurance and insurance policies.
 15. Performance and payment bonds.
 16. Data needed to acquire Owner's insurance.

- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
 1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706.
 5. AIA Document G706A.
 6. AIA Document G707.
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

END OF SECTION 01 2900

SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. RFIs.
 - 3. Digital project management procedures.
 - 4. Project meetings.
- B. Related Requirements:
 - 1. Section 01 7300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 2. Section 01 9113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.
- C. Related Requirements:
 - 1. Section 01 7300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 2. Section 01 7700 "Closeout Procedures" for coordinating closeout of the Contract.
 - 3. Section 01 9113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.2 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule.
 - 2. Preparation of the schedule of values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.

1.5 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 - 1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
 - 3. Owner's cost for Architect's services, at Architect's normal billing rate, in responding to requests for information from the Contractor, will be deducted from the Contract Amount if the intent of the documents is clear in the opinion of the Architect.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 - 1. Project name.
 - 2. Owner name.

3. Name of Architect and Construction Manager.
 4. Date.
 5. Name of Contractor.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: AIA Document G716 or software-generated form with substantially the same content as indicated above, acceptable to Architect.
- D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect or Construction Manager of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 2600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect and Construction Manager.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.

7. Date Architect's and Construction Manager's response was received.

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

1.6 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in AutoCAD 2016.
4. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement with modifications in Document 00 6324 'BIM Transfer Waiver'.
 - a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.

- B. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in Revit.
4. To obtain BIM Model, Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement, with modifications on Document 00 6324 "BIM Transfer Waiver."
 - a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106, with modifications on Document 00 6324 "BIM Transfer Waiver."

- C. Conditions of Use of Architect's Digital Data Files: As follows:

1. Architect makes no representation as to the compatibility of these files with user's hardware or software beyond the specified release of the referenced specifications.
2. Data contained on these electronic files are part of Architect's instruments of service and shall not be used by receiving party or anyone else receiving this data through or from receiving party for any purpose other than as a convenience in the support of construction coordination for the referenced project. Any other use or reuse by receiving party or by others will be at receiving party's sole risk and without liability or legal exposure to Tower Pinkster Titus Associates. Receiving party agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against the Architect, its officers, directors, employees, agents or subconsultants that may arise out of or in connection with receiving party's use of the electronic files.

3. Furthermore, receiving party shall, to the fullest extent permitted by law, indemnify and hold Architect harmless against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising out of or resulting from receiving party's use of these electronic files.
4. These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. We make no representation regarding the accuracy or completeness of the electronic files receiving party receives. In the event that a conflict arises between the hard-copy construction documents prepared by Architect and the electronic files, the hard-copy construction documents shall govern. Receiving party is responsible for determining if any conflict exists. By receiving party's use of these electronic files, receiving party is not relieved of any duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project.
5. Because information presented on the electronic files can be modified, unintentionally or otherwise, Architect reserves the right to remove all indicia of ownership and/or involvement from each electronic display.

D. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

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

1.7 PROJECT MEETINGS

- A. General: Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
- B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 1. Attendees: Authorized representatives of Owner, **Owner's Commissioning Authority**, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.

- j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - l. Distribution of the Contract Documents.
 - m. Submittal procedures.
 - n. Preparation of Record Documents.
 - o. Use of the premises.
 - p. Work restrictions.
 - q. Working hours.
 - r. Owner's occupancy requirements.
 - s. Responsibility for temporary facilities and controls.
 - t. Procedures for moisture and mold control.
 - u. Procedures for disruptions and shutdowns.
 - v. Construction waste management and recycling.
 - w. Parking availability.
 - x. Office, work, and storage areas.
 - y. Equipment deliveries and priorities.
 - z. First aid.
 - aa. Security.
 - bb. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager, **and Owner's Commissioning Authority** of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Sustainable design requirements.
 - i. Review of mockups.
 - j. Possible conflicts.
 - k. Compatibility requirements.
 - l. Time schedules.
 - m. Weather limitations.
 - n. Manufacturer's written instructions.
 - o. Warranty requirements.
 - p. Compatibility of materials.
 - q. Acceptability of substrates.
 - r. Temporary facilities and controls.
 - s. Space and access limitations.
 - t. Regulations of authorities having jurisdiction.

- u. Testing and inspecting requirements.
 - v. Installation procedures.
 - w. Coordination with other work.
 - x. Required performance results.
 - y. Protection of adjacent work.
 - z. Protection of construction and personnel.
 - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Construction Manager will conduct progress meetings at **regular** intervals.
- 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner, **Owner's Commissioning Authority**, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Status of sustainable design documentation.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site use.
 - 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.
 - 15) Status of Proposal Requests.
 - 16) Pending changes.
 - 17) Status of Change Orders.

- 18) Pending claims and disputes.
 - 19) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

END OF SECTION 01 3100

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 01 2900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01 3100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 01 4000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
4. Section 01 7700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
5. Section 01 7823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
6. Section 01 7839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
7. Section 01 7900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's and Construction Manager's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect and Construction Manager on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.5 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
 - a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - a. Completeness: Submittal packages that do not contain all required submittals, with the exception of verification samples when selection samples are also required, will be returned without the Architect and Construction Manager taking action.
 - 3. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow **15** days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. **Construction Manager** will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Resubmittal Review: Allow 15 days for review of each resubmittal.
 - 3. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

1.6 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - 5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.

2. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Documents will be provided, when requested, by the Architect for Contractor's use in preparing submittals. Refer to Specification Section 00 6324. Only files required for the preparation of the Shop Drawings are to be requested.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture, and other similar types of variations are expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
 5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.7 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect and Construction Manager will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

- A. Action Submittals: Architect and Construction Manager will review each submittal, indicate corrections or revisions required, and return it.
 1. PDF Submittals: Architect and Construction Manager will indicate, via markup on each submittal, the appropriate action, as follows:
 - a. Reviewed: No corrections, no marks. Submittal complies with the design intent of the Contract Documents.
 - b. Furnish as Corrected: Minor corrections; all items can be fabricated or furnished without further correction; checking is complete and all corrections are obvious without ambiguity.
 - c. Revise and Resubmit: Minor corrections; noted items must not be furnished or fabricated without further corrections; checking is not complete; details of items noted are to be clarified before resubmitting; items not noted to be corrected can be fabricated or furnished under this stamp.
 - d. Rejected: Submittal is not in compliance with the design intent of the Contract Documents. Provide new submittal that complies with Contract Documents. Any delay resulting from the submission of items not complying with the Contract Documents is solely the responsibility of the Contractor, which will bear all associated costs.
- B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect **and Construction Manager**.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect and Construction Manager will return without review submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

END OF SECTION 01 3300

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, **Commissioning Authority**, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
 - 1. Mockups are used for one or more of the following:
 - a. Verify selections made under Sample submittals.
 - b. Demonstrate aesthetic effects.
 - c. Demonstrate the qualities of products and workmanship.
 - d. Demonstrate successful installation of interfaces between components and systems.
 - e. Perform preconstruction testing to determine system performance.
 - 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.

- 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory has the same meaning as testing agency.
- I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect or Construction Manager.

1.3 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1.4 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for direction before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

- A. Delegated-Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit documents signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services. Provide calculations for review.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience, include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- C. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.

- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - 1. Statement on condition of substrates and their acceptability for installation of product.
 - 2. Statement that products at Project site comply with requirements.
 - 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 5. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - 1. Statement that equipment complies with requirements.
 - 2. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 3. Other required items indicated in individual Specification Sections.

1.8 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and will engage for the activities indicated.
 - 1. Requirements of authorities having jurisdiction supersede requirements for specialists.

- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and **Commissioning Authority**, with copy to Construction Manager. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups of size indicated.
 - 2. Build mockups in location indicated or, if not indicated, as directed by Architect or Construction Manager.
 - 3. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
 - 4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
 - 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 6. Obtain Architect's and Construction Manager approval of mockups before starting corresponding work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 8. Demolish and remove mockups when directed unless otherwise indicated.

1.9 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - b. Testing will not be performed by the installer, or a subcontractor to the installer.
 - 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform duties of Contractor.

- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 3300 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Associated Contractor Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 SPECIAL TESTS AND INSPECTIONS

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

6. Retesting and reinspecting corrected work.
- C. Engage testing and inspection services except where indicated as by Owner in other Specification Sections.

PART 2 - EXECUTION

2.1 TEST AND INSPECTION LOG

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

2.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 7300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 4000

SECTION 01 4200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- C. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- D. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- E. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- F. "Provide": Furnish and install, complete and ready for the intended use.
- G. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of

Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.

- c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
 - 6. MILSPEC - Military Specification and Standards; (See DOD).
 - 7. USAB - United States Access Board; www.access-board.gov.
 - 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
- 1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 - 2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 - 3. CDHS; California Department of Health Services; (See CDPH).
 - 4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cdph.ca.gov/Programs/CCDCPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
 - 5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
 - 6. MDOT; Michigan Department of Transportation; www.michigan.gov/mdot.
 - 7. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
 - 8. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservation.tamu.edu.

END OF SECTION 01 4200

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SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 01 2500 "Substitution Procedures" for requests for substitutions.
 - 2. Section 01 4200 "References" for applicable industry standards for products specified.
 - 3. Section 01770 "Closeout Procedures" for submitting warranties.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified

under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 3300 "Submittal Procedures."
- F. Substitution: Refer to Section 01 2500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

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

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.
- C. Storage:
 - 1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
 - 2. Store products to allow for inspection and measurement of quantity or counting of units.
 - 3. Store materials in a manner that will not endanger Project structure.
 - 4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.

5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.5 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect through Construction Manager in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.
 7. All products shall be free from asbestos.
- B. Product Selection Procedures:
1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
 2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
 3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
 4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
 - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
 5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
 6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."

- b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
 - 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 2500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 2500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.
 - 1. Select products for which sustainable design documentation submittals are available from manufacturer.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
 - 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.

- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 3300 "Submittal Procedures."
 - 1. Form of Approval of Submittal: As specified in Section 01 3300 "Submittal Procedures."
 - 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.
- D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

END OF SECTION 01 6000

SECTION 01 7300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner's portion of the Work.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 01 3300 "Submittal Procedures" for submitting surveys.
 - 2. Section 01 7700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.2 DEFINITIONS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certified Surveys: Submit **two** copies signed by **land surveyor** or **professional engineer**.
- C. Certificates: Submit certificate signed by **land surveyor** or **professional engineer**, certifying that location and elevation of improvements comply with requirements.
- D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.4 CLOSEOUT SUBMITTALS

- A. Final Property Survey: Submit **10** copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
 - 5. Entity performing cutting and patching shall be experienced and skilled in working with the material being cut and patched.
 - 6. Verify utilities under Slab on Grade concrete by scanning the floors.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
 - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, **mechanical and electrical systems**, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 4. Perform a scan of Slab on Grade concrete to determine any utilities under or in the concrete to be removed.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - 1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
 - 2. List of detrimental conditions, including substrates.
 - 3. List of unacceptable installation tolerances.
 - 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Perform a scan of Slab on Grade concrete to determine any utilities under or in the concrete to be removed
- C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect through Construction Manager in accordance with requirements in Section 01 3100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - a. Include footings, foundations, anchor bolts, and similar items.
 - 6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey

markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

3.4 FIELD ENGINEERING

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

3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb, and make horizontal work level.

2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 2. Allow for building movement, including thermal expansion and contraction.
 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
1. Comply with Section 01 7700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.6 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 01 1000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 1. Verify utilities under Slab on Grade concrete by scanning the floors
 2. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 3. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 4. **Concrete and Masonry:** Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 5. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 6. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 7. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 4000 "Quality Requirements."

3.8 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 7300

SECTION 01 7700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
- B. Related Requirements:
 - 1. Section 01 7823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 2. Section 01 7839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 3. Section 01 7900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 ACTION SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of [10] <Insert number> days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by **Construction Manager**. Label with manufacturer's name and model number.
 - 5. Submit testing, adjusting, and balancing records.
 - 6. Submit sustainable design submittals not previously submitted.
 - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 8. Submit certification that no asbestos-containing materials were incorporated into the Work.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 7900 "Demonstration and Training."
 - 6. Advise Owner of changeover in utility services.
 - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 - 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 9. Complete final cleaning requirements.
 - 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or

will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.6 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Section 01 2900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Specific warranties as specified in individual Specification Sections.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.7 LIST OF INCOMPLETE ITEMS

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

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit by email to Architect.
- E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.

- f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
- g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
- h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
- i. Vacuum and mop concrete.
- j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
- k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
- l. Remove labels that are not permanent.
- m. Wipe surfaces of mechanical and electrical equipment[, **elevator equipment,**] and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- p. Clean ducts, blowers, and coils **if units were operated without filters during construction or that display contamination with particulate matter on inspection.**
 - 1) Clean HVAC system in compliance with **NADCA ACR**. Provide written report on completion of cleaning.
- q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
- r. Clean strainers.
- s. Leave Project clean and ready for occupancy.

- C. Construction Waste Disposal: Comply with waste-disposal requirements in **Construction Manager's Project Manual**.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 01 7300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 7700

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SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Systems and equipment operation manuals.
 - 3. Systems and equipment maintenance manuals.
 - 4. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 3300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Section 01 9113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect **and Commissioning Authority** will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect **and Commissioning Authority** will return copy with comments.

1. Correct or revise each manual to comply with Architect's and **Commissioning Authority's** comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and **Commissioning Authority's** comments and prior to commencing demonstration and training.
- D. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.5 REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Name and contact information for Commissioning Authority.
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
 1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
 1. Startup procedures.
 2. Equipment or system break-in procedures.

3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.7 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.
- C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.

- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.
- I. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1.8 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.

- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 -

END OF SECTION 01 7823

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 01 7300 "Execution" for final property survey.
 - 2. Section 01 7700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 01 7823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up record prints.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

1.3 RECORD DRAWINGS

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

- d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or [**Construction**] [**Work**] Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect **and Construction Manager**. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
 2. Format: Annotated PDF electronic file **with comment function enabled**.
 3. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 4. Refer instances of uncertainty to Architect through Construction Manager for resolution.
 5. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 01 3100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Format: Annotated PDF electronic file with comment function enabled.
 2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 3. Identification: As follows:

- a. Project name.
- b. Date.
- c. Designation "PROJECT RECORD DRAWINGS."
- d. Name of Architect and Construction Manager.
- e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

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

1.5 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
- C. Format: Submit Record Product Data as annotated PDF electronic file.
 - 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from

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deterioration and loss. Provide access to Project Record Documents for Architect's and Construction Manager's reference during normal working hours.

END OF SECTION 01 7839

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For instructor and videographer.

1.3 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. At completion of training, submit complete training manual(s) for Owner's use prepared in same format required for operation and maintenance manuals specified in Section 01 7823 "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 4000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination."

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.

- e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 7823 "Operation and Maintenance Data."

- B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner , through Construction Manager, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral, written, or demonstration performance-based test.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
 - 1. Submit video recordings on CD-ROM or thumb drive.
 - 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
 - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.

- c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
- E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 01 7900

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SECTION 01 9113 - GENERAL COMMISSIONING REQUIREMENTS – V&T

PART 1 - GENERAL

1.1 SUMMARY

A. COMMISSIONING LEVEL:

1. Michigan Energy Code Verification and Testing (V&T)
 - a. Required for projects under 10,000 square feet.

B. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

C. Verification and testing during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
2. Verify and document proper performance of equipment and systems.

D. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

E. Related Sections:

1. Division 22 Section "Commissioning of Plumbing" for plumbing commissioning requirements.
2. Section 23 0800 "Commissioning of HVAC" for technical commissioning requirements for HVAC.
3. Section 26 0800 "Commissioning of Electrical Systems" for technical commissioning requirements for communications systems and electrical systems.

1.2 ABBREVIATIONS

A. The following are common abbreviations used in the Specifications and in the Commissioning Plan.

A/E	Architect and design engineers	GC	General contractor (prime)
BCxP	Building Commissioning Professional	CCP	Certified Commissioning Professional
CxA	Commissioning authority	MC	Mechanical contractor
CC	Controls contractor	OR	Owner's Representative
CM	Construction Manager	PC	Prefunctional checklist
Cx	Commissioning	PM	Project manager (of the Owner)
Cx Plan	Commissioning Plan document	Subs	Subcontractors to General
EC	Electrical contractor	TAB	Test and balance contractor
FT	Functional performance test		

1.3 DEFINITIONS

- A. Architect/Engineer (A/E): The prime consultant (architect) and sub-consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer.
- B. Commissioning Authority (CxA): An independent agent hired by the Owner. The CxA directs and coordinates the day-to-day commissioning activities. The CxA does not take an oversight role like a CM.
- C. Commissioning Plan (Cx Plan): A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process
- D. Deferred Functional Tests : FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.
- E. Deficiency : A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).
- F. Factory Testing: Testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.
- G. Functional Performance Test (FT): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) 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). 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. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after prefunctional checklists and startup are complete.
- H. General Contractor (GC): The prime contractor for this project. Generally refers to all the GC's subcontractors as well. Also referred to as the Contractor, in some contexts.
- I. Manual Test: Using 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").
- J. Non-Compliance: See Deficiency.
- K. Non-Conformance: See Deficiency.
- L. Over-Written Value: Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also "Simulated Signal."

- M. Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.
- N. Seasonal Performance Tests: FT that are deferred until the system(s) will experience conditions closer to their design conditions.
- O. Simulated Condition: Condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).
- P. Simulated Signal: Disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.
- Q. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.
- R. Startup: The initial starting or activating of dynamic equipment, including executing prefunctional checklists.
- S. Subs: The subcontractors to the GC who provide and install building components and systems.
- T. Test Procedures: The step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CxA.
- U. Trending: Monitoring using the building control system.
- V. Vendor: Supplier of equipment.
- W. Warranty Period: Warranty period for entire project, including equipment components.

1.4 QUALITY ASSURANCE

- A.
- B. CxA Individual Requirements:
 - 1. CxA Qualifications: Certified by ASHRAE (BCxP) or Building Commissioning Association (CCP).
 - 2. CxA shall furnish (3) example projects of similar size and scope along with owner references for each project.
 - 3. Third party entity, owners qualified employee, or individual from the firm/contractor not directly associated with design / installation.
- C. CxA Company Requirements:
 - 1. Company must employ at least (1) full-time licensed professional engineer.
 - 2. Provide company history, presenting evidence that building commissioning is a significant enterprise of the firm.
 - 3. Commissioning expertise and capabilities of the commissioning team.
 - 4. List of approved MEP commissioning firms:
 - 5.
 - a. Baumann Consulting
 - b. dbHMS
 - c. FISECx

- d. Fishbeck, Inc.
- e. Functional Consulting Services
- f. Peter Basso Associates Inc.
- g. Pro-MEC Engineering Services, Inc.
- h. TowerPinkster
- i. TriStar Engineering Group, Inc.

1.5 COORDINATION

- A. Commissioning Team: The members of the commissioning team consist of the Commissioning authority (CxA), the Owner's Representative (OR), the designated representative of the owner's Construction Management firm (CM), the General Contractor (GC or Contractor), the architect and design engineers (particularly the mechanical engineer), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB representative, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment. If known, the Owner's building or plant operator/engineer is also a member of the commissioning team.
- B. Management: The CxA is hired by the Owner directly. The CxA directs and coordinates the commissioning activities and the reports to the OR. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.
- C. Scheduling: The CxA will work with the CM and/or GC according to established protocols to schedule the commissioning activities. The CxA will provide sufficient notice to the CM and/or GC for scheduling commissioning activities. All commissioning activities shall be integrated into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.
- D. The CxA will provide the initial schedule of primary commissioning events at the commissioning kick-off meeting. As construction progresses more detailed schedules are developed by the CxA. The Commissioning Plan also provides a format for detailed schedules.

1.6 COMMISSIONING PROCESS – VERIFICATION AND TESTING (V&T)

- 1. Commissioning during construction begins with an initial commissioning meeting conducted by the CxA where the commissioning process is reviewed with the project commissioning team members.
- 2. Additional meetings will be required throughout construction, scheduled by the CxA, through the Owner or CM, with necessary parties attending to plan, scope, coordinate, schedule future activities and resolve issues.
- 3. Equipment documentation is submitted to the CxA, through the Owner or CM, during normal submittals, including detailed startup procedures.
- 4. CxA to obtain and review equipment startup logs from the contractors.
- 5. Startup and TAB must be completed before functional performance testing. CxA must have startup logs in hand prior to starting testing.
- 6. Items of non-compliance in material, installation, or setup shall be corrected at no expense to the Owner.
- 7. Any testing failure is to be corrected at no additional cost to the Owner, and a re-test is to be performed, observed, and documented.
- 8. The CxA develops and implements equipment and system functional performance test procedures. The forms and procedures are reviewed by the commissioning team.

9. The functional performance tests are executed by the contractor under the direction of the CxA with the assistance of the facility staff. All results are documented by the CxA.
10. Testing shall be completed before substantial completion with the exception of deferred testing.
11. The contractor develops procedures, reviews, coordinates, and implements owner's training.
12. Deferred testing is conducted as specified or required.
- 13.

1.7 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, the Construction Manager (CM) and representatives of the Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA. Required entities include but are not limited to the following:
 1. HVAC sheet metal.
 2. Test and Balance.
 3. DDC.
 4. Electrical.
- B. Members Appointed by Owner:
 1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
 2. Representatives of the facility user and operation and maintenance personnel.
 3. The Owners Representative. (If Applicable)
 4. Architect and engineering design professionals.
 5. Construction Manager.

1.8 OWNER'S RESPONSIBILITIES

- A. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
- B. Attend commissioning scoping meetings and additional meetings as necessary.

1.9 OWNERS REPRESENTATIVE'S RESPONSIBILITIES (IF APPLICABLE)

- A. The Owner's Representative (OR) shall represent the Owner during the commissioning process as follows:
 1. Provide final approval for the completion of the commissioning work.
 2. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.
 3. Attend commissioning scoping meetings and additional meetings as necessary.

1.10 ARCHITECT/ENGINEERS (AE) RESPONSIBILITIES

- A. The AE shall participate in and perform commissioning process activities including, but not limited to, the following:
1. Attend the commissioning kick-off meeting and selected commissioning team meetings.
 2. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.
 3. Provide any design narrative and sequence documentation requested by the CxA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
 4. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
 5. Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning.

1.11 CONSTRUCTION MANAGER'S (CM) RESPONSIBILITIES

- A. The construction manager shall participate in and perform commissioning process activities including, but not limited to the following:
1. The Construction Manager shall diligently track, manage, and ensure the timely correction of all Commissioning deficiencies identified during the Commissioning process. The CM shall work collaboratively with the Contractor(s) and Commissioning Agent to establish reasonable timelines for the resolution of each deficiency and shall proactively monitor progress against these timelines. Failure to ensure timely correction of deficiencies that impact project completion, system performance, or life safety shall constitute a breach of this Agreement.
 2. Facilitate the coordination of the commissioning work by the CxA, and, with the GC and CxA, ensure that commissioning activities are being scheduled into the master schedule.
 3. Attend commissioning team meetings.
 4. Perform the normal review of Contractor submittals.
 5. Furnish a copy of all construction documents, addenda, requests for information, change orders and approved submittals and shop drawings related to commissioned equipment to the CxA.
 6. Review commissioning progress and deficiency reports.
 7. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.

1.12 CONTRACTOR'S RESPONSIBILITIES (or "PRIME CONTRACTOR", IF APPLICABLE)

- A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
1. The Contractor shall be solely responsible for ensuring that all Work is fully complete, correctly installed, and functionally tested in accordance with the Contract Documents, including adherence to the specified sequence of operations, prior to notifying the Owner or the Commissioning Agent that the systems are ready for performance testing. The Contractor shall provide documented evidence of successful completion of their internal testing and verification processes. The

- Commissioning Agent will not commence performance testing until the Contractor has certified in writing that the Work is complete, correct, and has passed all required pre-commissioning tests.
2. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
 3. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
 4. Attend commissioning team meetings held on a monthly basis.
 5. Integrate and coordinate commissioning process activities with construction schedule.
 6. Review commissioning progress and deficiency reports.
 7. Complete commissioning process test procedures.
 8. Include the cost of commissioning in the total contract price.
 9. Coordinate the training of Owner personnel and provide the times and dates of training to the CxA.
 10. Execute seasonal or deferred functional performance testing witnessed by the CxA to facilitate the Cx process.
 11. Provide a list of final settings, setpoints, ranges, schedules, and / or trend logs required by the CxA.
 12. Provide point-to-point check logs as required by Instrumentation and Controls Specification 23 0900 prior to functional performance testing.
 13. Provide screenshots of key operating configurations for each equipment type to CxA prior to functional performance testing.
 14. Follow the Commissioning Plan.
 15. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
 16. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CxA.
 17. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
 18. Review test procedures for equipment installed by factory representatives.

1.13 EQUIPMENT SUPPLIERS RESPONSIBILITIES

- A. The equipment suppliers shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
 2. Assist in equipment testing per agreements with Subs.
 3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CxA.
 4. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

1.14 CxA'S RESPONSIBILITIES – VERIFICATION AND TESTING (V&T)

1. For each system or piece of equipment undergoing Commissioning performance testing, a maximum of **[two (2)]** retests will be conducted by the Commissioning Agent due to initial failures that are directly attributable to incomplete or incorrect Contractor Work. Any subsequent retesting required due to continued failures resulting from the Contractor's deficiencies shall be performed at the

- Contractor's sole expense, including but not limited to the Commissioning Agent's fees, and any associated delays to the Project Schedule.
2. The Commissioning Agent's obligation for retesting is limited to verifying the specific items identified in the original deficiency report. If, during a scheduled retest, additional unrelated failures or incomplete corrections are discovered, the following shall apply: a. The Commissioning Agent will document the new findings and may suspend the retesting of that system or component. b. The Contractor shall be responsible for correcting all identified deficiencies, both original and newly discovered, and shall provide a revised schedule for subsequent testing. c. Any additional time or resources expended by the Commissioning Agent due to the discovery of new failures during retesting, including additional site visits, report revisions, or schedule adjustments, shall be considered an Additional Service and shall be compensated by the [Owner/Contractor, specify who pays] in accordance with the terms of this Agreement. The intent of this clause is to ensure that the Commissioning Agent's retesting efforts are focused and efficient, and that the Contractor bears the responsibility for ensuring the overall completeness and correctness of their Work.
 3. Coordinates and directs the commissioning activities using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
 4. Coordinate the commissioning work and, with the GC and CM, ensure that commissioning activities are being scheduled into the master schedule.
 5. Attend OAC meetings to coordinate V&T schedule.
 6. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
 7. With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.
 8. Analyze any functional performance trend logs and monitoring data to verify performance.
 9. Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary.
 10. Maintain a master deficiency and resolution log.
 11. Document third party tests and include this documentation in Commissioning Report.
 12. Provide a final V&T Report – refer to articles below for required contents of V&T report.
 13. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.

1.15 SYSTEMS TO BE COMMISSIONED

- A. The following systems will be commissioned for this project. Refer to equipment schedules for quantities.

1. Building Management System
- 2.
3. Plumbing Systems:
 - a. Booster Pumps
 - b. Compressed Air Systems
 - c. Domestic Hot Water Systems
 - d. Elevator Sump Pumps
 - e. Grease Separators
 - f. Irrigation Systems
 - g. Oil Separators
 - h. Pool Heaters
 - i. Recirculation Pumps
 - j. Sump pumps

- k. Temperature Mixing Valves
- l. Water Softener Systems
- 4. HVAC Systems:
 - a. Air Cleaning Devices
 - b. Air Handling Units
 - c. Cabinet Heaters
 - d. Chilled Water Systems
 - e. Computer Room Air Conditioning Units
 - f. Condensate Receiver
 - g. Convectors
 - h. Cooling Towers
 - i. Dedicated Outdoor Air Systems
 - j. Duct Mounted Coils
 - k. Energy Recovery Units
 - l. Energy Recovery Ventilators
 - m. Exhaust Fans
 - n. Fan Coil Units
 - o. Finned Tubes
 - p. Forced Air Furnaces
 - q. Geothermal Systems
 - r. Glycol Makeup Units
 - s. Heat Exchangers
 - t. Heat Pumps
 - u. Heat Recovery Units
 - v. Heating Hot Water Systems
 - w. High Volume Low Speed Fans
 - x. Humidifiers
 - y. Laboratory Exhaust Fans
 - z. Makeup Air Units
 - aa. Mini-Splits
 - bb. Packaged AC units
 - cc. Pumps
 - dd. Radiant Floors
 - ee. Radiant Heaters
 - ff. Radiant Panels
 - gg. Rooftop Units
 - hh. Snowmelt Systems
 - ii. Solar Water Heating Systems
 - jj. Steam Systems
 - kk. Terminal Units
 - ll. Trench Heaters
 - mm. Unit Heaters
 - nn. Unit Ventilators
 - oo. Variable Refrigerant Flow Systems
- 5. Electrical Systems:
 - a. Automatic Transfer Switches (ATS)
 - b. Elevator Standby Controls
 - c. Emergency Backup Generators
 - d. Energy Monitoring

- e. Ground Fault Circuit Interrupter (GFCI)
- f. Lighting (normal & emergency)
- g. Lighting Controls
- h. Solar Photovoltaics
- i. Uninterruptible Power Supply (UPS) Systems
- j. Variable Frequency Drives (VFD)
- k.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. This includes but is not limited to two-way radios, meters, and data recorders.
- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and shall be turned over to the Owner at Project closeout.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 MEETINGS

- A. Initial Meeting: The CxA, through the Owner/CM will schedule, plan, and conduct an initial commissioning meeting. The Contractor and Contractor's responsible parties are required to attend.
- B. Miscellaneous Meetings. Other meetings will be planned and conducted by the CxA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CxA will plan these meetings and will minimize unnecessary time being spent by Subs.
- C. Training: Before operation and maintenance training, the Contractor shall prepare and submit training plans for all systems to be commissioned. In addition to requirements specified in Division 01 Section "Demonstration and Training" the training plans shall also include the following:
 - 1. Review installed systems, subsystems, and equipment.
 - 2. Instructor qualifications.
 - 3. Instructional methods and procedures.
 - 4. Training module outlines and contents.

5. Course materials (including operation and maintenance manuals).
6. Locations and other facilities required for instruction.
7. Training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
8. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

3.2 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

- A. The following procedures apply to all equipment to be commissioned. Some systems that are not comprised so much of actual dynamic machinery, e.g., electrical system power quality, may have very simplified PCs and startup.
- B. Start-up and Initial Checkout Plan. The primary role of the CxA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed.
 1. The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan. The full start-up plan could consist of something as simple as:
 - a. The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
 - b. The manufacturer's normally used field checkout sheets.
 2. The full start-up procedures and the approval form may be provided to the CM for review and approval, depending on management protocol.
 3. Refer to the Acceptance Section requirements of each equipment specification for all Systems To Be Commissioned. Startup Logs and Acceptance Checklists must be completed prior to Functional Testing.
 4. The GC will issue a Certificate of Readiness for each of the commissioned systems, certifying that the system is ready for Functional Performance Testing.
- C. Sensor and Actuator Calibration
 1. All field-installed temperature, relative humidity, CO, CO2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if approved by the Owner before-hand. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
 2. Sensor Calibration Methods:
 - a. All Sensors: Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable, are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading, of each other, for pressure. Tolerances for critical applications may be tighter.
 - b. Sensors without Transmitters--Standard Application: Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in

the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.

- c. Sensors with Transmitters--Standard Application: Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction. Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.
- d. Critical Applications: For critical applications (process, manufacturing, etc.) more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

3. Tolerances, Standard Applications:

<u>Sensor</u>	<u>Required Tolerance (+/-)</u>	<u>Sensor</u>	<u>Required Tolerance (+/-)</u>
Cooling coil, chilled and condenser water temps	0.4F	Flow rates, water Relative humidity	4% of design 4% of design
AHU wet bulb or dew point	2.0F	Combustion flue temps	5.0F
Hot water coil and boiler water temp	1.5F	Oxygen or CO ₂ monitor	0.1 % pts
Outside air, space air, duct air temps	0.4F	CO monitor	0.01 % pts
Watt-hour, voltage & amperage	1% of design	Natural gas and oil flow rate	1% of design
Pressures, air, water and gas	3% of design	Steam flow rate	3% of design
Flow rates, air	10% of design	Barometric pressure	0.1 in. of Hg

4. Valve and Damper Stroke Setup and Check.

- a. BAS Readout: For all valve and damper actuator positions checked, verify the actual position against the BAS readout.
- b. Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required.

Command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

5. Closure for heating coil valves (NO): Set heating setpoint 20°F above room temperature. Observe valve open. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set heating setpoint to 20°F below room temperature. Observe the valve close. For pneumatics, by override in the EMS, increase pressure to valve by 3 psi (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change. Restore to normal.
6. Closure for cooling coil valves (NC): Set cooling setpoint 20°F above room temperature. Observe the valve close. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set cooling setpoint to 20°F below room temperature. Observe valve open. For pneumatics, by override in the EMS, increase pressure to valve by 3 psi (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change. Restore to normal.

D. Execution of Startup

1. The Subs and vendors shall execute startup and provide the CxA with a signed and dated copy of the completed start-up and start-up logs.
2. Only individuals that have direct knowledge and witnessed that a line item task on the start-up logs was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

E. Deficiencies, Non-Conformance and Approval in Startup

1. The Subs shall clearly list any outstanding items of the initial start-up procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CxA, Owner, and CM.
2. The CxA reviews the report and submits either a non-compliance report or an approval form to the Sub or CM. The CxA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CxA will involve the CM and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CxA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CxA recommends approval of the execution of the checklists and startup of each system to the CM using a standard form.
3. Items left incomplete, which later cause deficiencies or delays during functional testing may result in back charges to the Contractor.

3.3 PHASED COMMISSIONING

3.4 FUNCTIONAL PERFORMANCE TESTING

- A. This sub-section applies to all commissioning functional testing for all divisions.
- B. Objectives and Scope: The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally,

during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

1. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.
2. Zone Level (Exhaust fan) - Equipment shall be tested for both performance and alarm conditions. Review all graphics, conduct point-to-point checks, verify all setpoints and sequence of operation as outlined in the construction documents. Additionally, verify system interoperability to ensure AHU's enable / respond to local thermostat overrides or when CO2 levels increase (where applicable).
3. Coordination and Scheduling: The Contractor shall provide sufficient notice, regarding their completion schedule for the construction checklists and startup of all equipment and systems to allow the functional performance testing to be scheduled. The commissioning team shall oversee, witness, and document the functional performance of all equipment and systems. The Contractor/subcontractors shall execute the test, the CxA and Owner will witness and direct the tests. Performance testing shall be conducted after the construction checklists, and startup has been satisfactorily completed. The control system shall be sufficiently tested prior to use, to verify performance of other components or systems. The air balancing and water balancing shall be completed before functional testing of air or water related equipment or systems, Testing proceeds from components to sub-systems to systems. When the proper performance of all interacting individual systems has been achieved, the interface of coordinated responses between systems shall be checked.
4. Development of Test Procedures. Before test procedures are written, the CxA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. The CxA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test, shall provide assistance to the CxA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CxA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection. The CxA may submit the tests to the A/E for review, if requested.
5. The CxA shall review owner-contracted, factory testing or required owner acceptance tests which the CxA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the Specifications. Redundancy of testing shall be minimized.
6. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

C. Test Methods:

1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities.
2. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
3. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or

not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

4. Simulated Signal: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
 5. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55F, when the outside air temperature is above 55F, temporarily change the lockout setpoint to be 2F above the current outside air temperature.
 6. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.
 7. Setup: Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.
 8. Sampling: Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity.
 - a. A common sampling strategy such as the "xx% Sampling - yy% Failure Rule" is defined by the following example:
 - 1) xx = the percent of the group of identical equipment to be included in each sample.
 - 2) yy = the percent of the sample that if failing, will require another sample to be tested.
 - b. The example below describes a 20% Sampling—10% Failure Rule.
 - 1) Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."
 - 2) If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).
 - 3) If 10% of the units in the second sample fail, test all remaining units in the whole group.
 - 4) If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.
- D. Coordination and Scheduling. The Subs shall provide sufficient notice to the CxA regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems. The CxA will schedule functional tests through the CM, GC and affected Subs. The CxA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.
1. In general, functional testing is conducted after prefunctional testing and startup has been satisfactorily completed. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

- E. Problem Solving. The CxA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the GC, Subs and A/E.

3.5 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

- A. Documentation. The CxA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. CxA is responsible for all documentation of performance testing.
- B. Non-Conformance:
1. The CxA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the CM on a standard non-compliance form.
 2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.
 3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the CM.
 4. As tests progress and a deficiency is identified, the CxA discusses the issue with the executing contractor.
 - a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
 - 1) The CxA documents the deficiency and the Sub's response and intentions and they go on to another test or sequence. After the day's work, the CxA submits the non-compliance reports to the CM for signature, if required. A copy is provided to the Sub and CxA. The Sub corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CxA.
 - 2) The CxA reschedules the test and the test is repeated.
 - b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
 - 1) The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the CM and to the Sub representative assumed to be responsible.
 - 2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Project Manager.
 - 3) The CxA documents the resolution process.
 - 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CxA. The CxA reschedules the test and the test is repeated until satisfactory performance is achieved.
 5. Cost of Retesting:
 - a. The cost for the Sub to retest a prefunctional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.
 - b. For a deficiency identified, not related to any prefunctional checklist or start-up fault, the following shall apply: The CxA and CM will direct the retesting of the equipment once at no

- “charge” to the GC for their time. However, the CxA’s and CM’s time for a second retest will be charged to the GC, who may choose to recover costs from the responsible Sub.
- c. The time for the CxA and CM to direct any retesting required because a specific prefunctional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the GC, who may choose to recover costs from the party responsible for executing the faulty prefunctional test.
 - d. Refer to the “Sampling” subparagraph above for requirements for testing and retesting identical equipment.
6. The Contractor shall respond in writing to the CxA and CM at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
 7. The CxA retains the original non-conformance forms until the end of the project.
 8. Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.
- C. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CM or OR. In such case, the Contractor shall provide the Owner with the following:
1. Within one week of notification from the CM or OR, the Contractor or manufacturer’s representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CM or OR within two weeks of the original notice.
 2. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
 3. The CM or OR will determine whether a replacement of all identical units or a repair is acceptable.
 4. Two examples of the proposed solution will be installed by the Contractor and the CM will be allowed to test the installations for up to one week, upon which the CM or OR will decide whether to accept the solution.
 5. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- D. Acceptance: The CxA notes each satisfactorily demonstrated function on the test form. Final acceptance of the performance test by the Owner is made after review by the CxA and CM, following recommendations by the A/E.
- 3.6 DEFERRED TESTING
- A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the Owner. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

- B. Seasonal Testing: During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CxA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and as-builds due to the testing will be made.

3.7 OPERATION AND MAINTENANCE MANUALS

- A. Standard O&M Manuals:
1. The specific content and format requirements for the standard O&M manuals are detailed in Section 01 7823.
 2. Contractor shall submit final approved manuals prior to substantial completion.

3.8 FINAL V&T REPORT

- A. The final verification and testing report shall include an executive summary, list of participants and roles, brief building description, list of tested equipment, and a general description of testing and verification methods. All outstanding non-compliance items shall be specifically listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

3.9 WRITTEN WORK PRODUCTS

- A. The commissioning process generates a number of written work products described in various parts of the Specifications. The Commissioning Plan—Construction Phase, lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them. In summary, the written products are:

Product	Developed By
Testing readiness schedules	CxA with GC and CM
Equipment documentation submittals	Subs
Sequence clarifications	Subs and A/E as needed
Startup Logs and Acceptance Checklists	Manufacturer provided / Filled out by CM
Startup and initial checkout plan	Subs and CxA (compilation of existing documents)
Startup and initial checkout forms filled out	Subs
Final TAB report	TAB
Issues log (deficiencies)	CxA
Functional test forms	CxA
Filled out functional tests	CxA
O&M manuals	Subs
Final V&T report	CxA

PROJECT NO. 22-136.03
MONTAGUE APS - AGRICULTURAL CLASSROOM AND BARN
MONTAGUE AREA PUBLIC SCHOOLS

GENERAL COMMISSIONING REQUIREMENTS - V&T

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JUNE 30, 2026

END OF SECTION 01 9113

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SECTION 01 9119.43 - EXTERIOR ENCLOSURE COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes building enclosure Cx process requirements for the above- and below-grade systems and assemblies:
 - 1. Horizontal and vertical waterproofing.
 - 2. Opaque walls.
 - 3. Roofs.
 - 4. Openings.
 - 5. Interfaces.
- B. Commissioning Path
 - 1. Design and Verification Program
- C. Related Requirements:
 - 1. Section 01 9113 "General Commissioning Requirements" for general requirements for Cx processes including definitions, Cx team membership, Owner's responsibilities, Contractor's responsibilities, and CxA's responsibilities.

1.3 DEFINITIONS

- A. Building Enclosure: Materials, components, systems, and assemblies intended to provide shelter and environmental separation between interior and exterior, or between two or more environmentally distinct interior spaces in a building or structure. The building enclosure includes, but is not limited to, exterior walls, above and below grade, and roof assemblies.
- B. Cx: Commissioning, as defined in Section 01 9113 "General Commissioning Requirements."
- C. CxA: Commissioning Authority, as defined in Section 01 9113 "General Commissioning Requirements."
- D. First-Installation Mockups: Initial installation of specific enclosure materials, components, systems, and assemblies that are part of Work.
- E. Integrated Exterior Mockups: Integrated mockups of the exterior enclosure erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.

- F. Laboratory Mockups: Full-size physical assemblies constructed at testing facility.
- G. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.
- H. Water Penetration: Visible evidence of uncontrolled water penetration on or adjacent to the test specimen in a location not intended to collect and drain water to the building exterior.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Construction Checklists: Draft Construction Checklists will be created by CxA for Contractor review.
- C. Cx Process Submittals:
 - 1. Shop Drawings: For mockups, including elevations, plans, sections, and full-size details. Show interface conditions, interconnections, and terminations.
 - 2. Testing Program: Developed specifically for Project.
 - 3. Test Reports: Prepared by a qualified testing agency for each test.
 - 4. Record Drawings: As-built drawings of mockups showing changes made during testing.
- D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For building envelope systems and components to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE FOR DESIGN AND VERIFICATION

- A.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONSTRUCTION CHECKLISTS

- A. Prepare detailed Construction Checklists for exterior enclosure Cx systems, subsystems, equipment, and components. Complete and submit Construction Checklists.

3.2 CONSTRUCTION CHECKLIST REVIEW

- A. Review and provide written comments on draft Construction Checklists. CxA will create required draft Construction Checklists and provide them to Contractor.
- B. Return draft Construction Checklist review comments within **10** days of receipt.
- C. When review comments have been resolved, CxA will provide final Construction Checklists, marked "Approved for Use, (date)."
- D. Use only Construction Checklists, marked "Approved for Use, (date)."

END OF SECTION 01 9119.43

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SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 31 2000 "Earth Moving" for drainage fill under slabs-on-grade.
 - 2. Section 32 1313 "Concrete Paving" for concrete pavement and walks.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement.
 - 1. Prepare Shop Drawings in accordance with ACI 315 and 315R and the CRSI Manual of Standard Practice and Reinforcing Bar Detailing.
 - 2. Shop Drawings should include the following at a minimum:
 - a. Number, size, length and location of concrete reinforcement. Each bar should be identified using a unique mark.
 - b. Bending diagrams.
 - c. For concrete columns: provide full elevation of column member showing elevations of intersecting floors, beams, bar splices, and size and spacing of all ties.

1.3 INFORMATIONAL SUBMITTALS

- A. Material test reports.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.6 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1.
 - 1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI 117.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.3 CONCRETE MATERIALS

- A. Cementitious Materials:
 - 1. Blended Portland Cement: ASTM C 595, Type IL.
 - 2. Fly Ash: ASTM C 618, Class F.
 - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33/C 33M, graded.
 - 1. Maximum Coarse-Aggregate Size: **3/4 inch** nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

3. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 sieve, and less than 8 percent may be retained on sieves finer than No. 50.
- C. Air-Entraining Admixture: ASTM C 260/C 260M.
- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
- E. Water: ASTM C 94/C 94M and potable.
- F. Porosity-Reducing Admixture: Proprietary formulation that reduces concrete porosity by closing capillaries in the concrete as it cures.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Concrete Moisture Solutions, Inc.; Barrier One.
 - b. ISE Logik Industries; MVRA 900.
 - c. Specialty Products Group; Vapor Lock 20/20.

2.4 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A, except with maximum water-vapor permeance of 0.02 U.S. perms, minimum 15 mils thick monolithic polyolefin sheet. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fortifiber Building Systems Group; Moistop Ultra 15.
 - b. Insulation Solutions, Inc.; Viper VaporCheck II 15-mil.
 - c. Poly-America, L.P.; Husky Yellow Guard Vapor Barrier 15 Mil ASTM E-1745 Class A.
 - d. Reef Industries, Inc; Griffolyn 15 mil Green.
 - e. Stego Industries, LLC; Stego Wrap 15 mil Class A.

2.5 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment (SC-1): Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ChemMasters, Inc; Chemisil Plus.
 - b. Curecrete Distribution Inc.; Ashford Formula.
 - c. Dayton Superior; Sure Hard Densifier J17.
 - d. Euclid Chemical Company (The); an RPM company; Euco Diamond Hard.
 - e. L&M Construction Chemicals, Inc; Seal Hard.
 - f. PROSOCO, Inc; Consolideck LS by PROSOCO.

2.6 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ChemMasters, Inc; Spray-Film.
 - b. Dayton Superior; AquaFilm Concentrate J74.
 - c. Euclid Chemical Company (The); an RPM company; Eucobar.
 - d. L&M Construction Chemicals, Inc; E-CON.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.8 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. 20 percent fly ash or 30 percent ground blast furnace slag.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use porosity-reducing admixture in slabs.

2.9 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Slabs-on-Grade: Normal-weight concrete.
 - 1. Minimum Compressive Strength: As indicated at 28 days.
 - 2. Maximum W/C Ratio: 0.50.
 - 3. Minimum Cementitious Materials Content: 470 lb/cu. yd..
 - 4. Slump Limit: 5 inches, plus or minus 1 inch.
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

B. Normal-Weight Concrete:

1. Minimum Compressive Strength: As indicated at 28 days.
2. Maximum W/C Ratio: **0.50**.
3. Slump Limit: 5 inches, plus or minus 1 inch.

2.10 FABRICATING REINFORCEMENT

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

2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.2 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.3 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.4 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
 - 2. Joints shall be spaced in panels no more than 12-feet on a side, with a maximum width:length aspect ratio of 1.5:1.0.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as columns, concrete piers, foundation walls, grade beams, and other locations, as indicated.

3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3.6 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces **to receive trowel finish** .
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces **exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.**
 - 2. Finish surfaces to the following tolerances, according to **ASTM E 1155**, for a randomly trafficked floor surface:

3. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed **1/4 inch**.
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces **where ceramic or quarry tile is to be installed by either thickset or thinset method**. While concrete is still plastic, slightly scarify surface with a fine broom.
 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.7 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 3. Curing Compound: Do not use curing compounds.

3.8 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
 1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

- a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
 1. Headed bolts and studs.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 5. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 6. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure two sets of two 6-inch by 12-inch or two sets of three 4-inch by 8-inch cylinder specimens for each composite sample.
 7. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of laboratory-cured specimens at seven days and one set of specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
 9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 10. Additional Tests:
 - a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.
 11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Architect.

END OF SECTION 03 3000

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SECTION 04 2200 - 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.

B. Related Requirements:

1. Section 05 1200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.

1.2 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of product. For masonry units, include data on material properties.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.5 FIELD CONDITIONS

- A. 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.

- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 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.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- B. CMUs: ASTM C 90.
 - 1. Density Classification: Normal weight for below-grade applications and medium or normal weight for above-grade applications, unless indicated otherwise.

2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Aggregate for Mortar: ASTM C 144.

- E. Aggregate for Grout: ASTM C 404.
- F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- G. Water: Potable.

2.4 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Exterior and Interior Walls: Hot-dip galvanized, carbon steel.
 - 2. Wire Size for Side Rods: 0.148-inch diameter.
 - 3. Wire Size for Cross Rods: 0.148-inch diameter.
 - 4. Spacing of Cross Rods: 16 inches o.c.
 - 5. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.5 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
 - 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 - 3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized-steel wire.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized-steel wire.
- C. Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

2.6 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 C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For masonry below grade or in contact with earth, exterior above-grade load-bearing walls, exterior above grade nonload-bearing walls, and parapet walls use Type S.
 - 2. 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 C 476.
 - 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 C 476, Table 1.
 - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. 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.

3.2 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.

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 head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.3 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 and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at jambs.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- E. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 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. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 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.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

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

3.7 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/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.

3.8 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
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.
- B. Testing Prior to Construction: One set of tests.
- C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- F. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.9 REPAIRING, POINTING, AND CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.10 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. 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 04 2200

SECTION 05 5000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous framing and supports.
2. Steel framing and supports for overhead **doors**.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- 5.
6. Shelf angles.
7. Metal ladders.
8. Miscellaneous steel trim.
9. Steel angle corner guards, steel edgings and loading dock edge angles.
10. Metal bollards.
11. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
3. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Requirements:

1. Section 05 1200 "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, door frames, and other steel items attached to the structural-steel framing.

1.2 COORDINATION

- A. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Nonslip aggregates and nonslip-aggregate surface finishes.

2. Fasteners.
3. Shop primers.
4. Shrinkage-resisting grout.
5. Slotted channel framing.
6. Manufactured metal ladders.
7. Metal bollards.

- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Delegated Design Submittals: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.5 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design ladders.
- B. Structural Performance of Aluminum Ladders: Ladders are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.
- D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.
- E. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- F. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- G. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
 - 2. Galvanized Steel: ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.079-inch nominal thickness.
- H. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
- I. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
- J. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- K. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
- L. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.
- M. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).
- N. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (leaded red brass) or UNS No. C84400 (leaded semired brass).
- O. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.
- P. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless steel fasteners for fastening aluminum or stainless steel.
 - 2. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.
- E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: 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 in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.
- I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 09 9113 "Exterior Painting." and Section 09 9123 "Interior Painting."
- B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- E. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete: Comply with requirements in Section 03 3000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.
- G. Thermoplastic Sleeves: For pipe bollard covers, see drawings for requirements.

2.5 FABRICATION, GENERAL

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

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.

2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 1. Provide mitered and welded units at corners.
 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize and prime shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with zinc-rich primer.
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

- A. General:
 1. Comply with ANSI A14.3, except for elevator pit ladders.
 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Steel Ladders:
 1. Space siderails 18 inches apart unless otherwise indicated.
 2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
 3. Rungs: 1-inch- square, steel bars.
 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
 6. Nonslip Surfaces for Steel Ladders: Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) IKG.
 - 2) SlipNOT Metal Safety Flooring, division of Traction Technologies Holdings, LLC.
 7. Source Limitations: Obtain nonslip surfaces from single source from single manufacturer.

8. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
9. Galvanize and prime exterior ladders, including brackets.
10. Prime interior ladders, including brackets and fasteners, with zinc-rich primer.

C. Aluminum Ladders:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fixfast USA.
 - b. Halliday Products.
 - c. O'Keeffe's Inc.
 - d. Precision Ladders, LLC.
 - e. Royalite Manufacturing, Inc.
 - f. Thompson Fabricating, LLC.
 - g. UPNOVR, Inc.
2. Source Limitations: Obtain aluminum ladders from single source from single manufacturer.
3. Space siderails 18 inches apart unless otherwise indicated.
4. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
5. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
6. Fit rungs in centerline of siderails; fasten by welding or with stainless steel fasteners or brackets and aluminum rivets.
7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted aluminum brackets.

2.9 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize and prime exterior miscellaneous steel trim.
- D. Prime exterior miscellaneous steel trim with zinc-rich primer.

2.10 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
- B. Galvanize bollards after fabrication.

- C. Fabricate bollards for embedment in concrete footings.
- D. Thermoplastic Sleeves: For pipe bollard covers, see drawings for requirements.

2.11 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Finish: Leave unfinished

2.12 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches unless otherwise indicated.
- C. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.13 STEEL WELD PLATES AND ANGLES

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

2.14 GENERAL FINISH REQUIREMENTS

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

2.15 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

- C. Shop prime iron and steel items **not indicated to be galvanized** unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting" unless indicated otherwise.
- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.16 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

2.17 STAINLESS STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
 - 1. Bright, Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.
- C. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installation of Bearing and Leveling Plates" Article.
 - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLATION OF SHELF ANGLES

- A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

3.4 INSTALLATION OF METAL LADDERS

- A. Secure ladders to adjacent construction with the clip angles attached to the stringer.
- B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

3.5 INSTALLATION OF MISCELLANEOUS STEEL TRIM

- A. Anchor to concrete construction to comply with manufacturer's written instructions.

3.6 INSTALLATION OF METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 - 1. Do not fill removable bollards with concrete.

- B. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- C. Fill bollards solidly with concrete, mounding top surface or provide precast top to shed water.
- D. Install specified thermoplastic sleeves over metal bollards in accordance with manufacturer's printed instructions.

3.7 INSTALLATION OF ABRASIVE METAL NOSINGS, TREADS, AND THRESHOLDS

- A. Center nosings on tread widths unless otherwise indicated.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
- C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 07 9200 "Joint Sealants" to provide a watertight installation.

3.8 INSTALLATION OF LOOSE BEARING AND LEVELING PLATES

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

3.9 REPAIRS

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
 - 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 9113 "Exterior Painting." and Section 09 9123 "Interior Painting."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 5000

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SECTION 06 1000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood blocking and nailers.
2. Plywood backing panels.

B. Related Requirements:

1. Section 06 1600 "Sheathing" for sheathing, subflooring, and underlayment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
- F. Application: Treat **items indicated on Drawings, and the following:**
 - 1. Concealed blocking.
 - 2. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Grounds.
- B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any species.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine or southern pine; No. 3 grade; SPIB.
 - 2. Eastern softwoods; No. 3 Common grade; NeLMA.
 - 3. Northern species; No. 3 Common grade; NLGA.
 - 4. Western woods; Standard or No. 3 Common grade; WCLIB or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

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

2.6 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC58 as appropriate for the substrate.
 - 1. Material for Interior Applications: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material for Exterior Applications: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.
- E. Adhesives for Gluing **[Furring]** **[and]** **[Sleepers]** to Concrete or Masonry and contained in plywood or engineered wood: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 2. ICC-ES evaluation report for fastener.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 1000

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SECTION 06 1600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Canopy sheathing.
2. Subflooring.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/D 3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. **For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.**
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: **Treat plywood indicated on Drawings, and the following:**
 - 1. Canopy roof sheathing.
 - 2. Subflooring and underlayment for raised platforms.

2.2 CANOPY SHEATHING

- A. Plywood Sheathing:
 - 1. Span Rating: Not less than **24/0**.
 - 2. Nominal Thickness: Not less than **1/2 inch**.
- B. Oriented-Strand-Board Sheathing: DOC PS 2, **Exposure 1, Structural I** sheathing.
 - 1. Span Rating: Not less than **24/0**.
 - 2. Nominal Thickness: Not less than **1/2 inch**.

2.3 SUBFLOORING

- A. Plywood Combination Subfloor-Underlayment: DOC PS 1, **Exterior, Structural I, C-C Plugged** single-floor panels.
 - 1. Span Rating: Not less than **24**.
 - 2. Nominal Thickness: Not less than **7/8 inch**.
 - 3. Edge Detail: **Square**.
 - 4. Surface Finish: Fully sanded face.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For canopy sheathing, provide fasteners of **Type 304 stainless steel**.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.

- D. Coordinate canopy sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

END OF SECTION 06 1600

SECTION 06 4013 - EXTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior standing and running trim.
2. Exterior ornamental woodwork.
3. Shop priming of exterior architectural woodwork.
4. Shop finishing of exterior architectural woodwork.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing exterior architectural woodwork that are concealed within other construction before exterior architectural woodwork installation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Wood-Preservative Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Shop Drawings: For exterior architectural woodwork.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Initial Selection: For each type of exposed finish.

D. Samples for Verification: For the following:

1. Lumber for Exterior Wood-Stain Finish: Not less than 5 inches wide by 12 inches long, for each species, with one-half of exposed surface finished.
2. Lumber and Panel Products with Shop-Applied Opaque Finish: 5 inches wide by 12 inches long for lumber and **8 by 10 inches** for panels, for each finish system and color.
 - a. Finish **entire** exposed surface.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [Installer] [fabricator].

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.

1.5 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation of exterior architectural woodwork only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

PART 2 - PRODUCTS

2.1 EXTERIOR ARCHITECTURAL WOODWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of exterior architectural woodwork indicated for construction, finishes, installation, and other requirements.

2.2 EXTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Grade: **Premium**.
- B. Backout or groove backs of flat trim members, and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
- C. Wood Species: **Western red cedar** .

2.3 EXTERIOR ORNAMENTAL WOODWORK FOR OPAQUE FINISH

- A. Exterior ornamental woodwork for opaque finish includes the following:
 - 1. Decorative brackets.
- B. Grade: **Premium**.
- C. Wood Species: **Western red cedar**.

2.4 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of exterior architectural woodwork and quality grade specified unless otherwise indicated.
 - 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.

2. Wood Moisture Content: 9 to 15 percent.

2.5 PRESERVATIVE-TREATED-WOOD MATERIALS

- A. Preservative-Treated-Wood Materials: Provide with water-repellent preservative treatment complying with AWPA N1 (dip, spray, flood, or vacuum-pressure treatment).
 1. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
- B. Extent of Preservative-Treated Wood Materials: Treat wood materials **except items indicated to be fire-retardant treated**.

2.6 FIRE-RETARDANT-TREATED WOOD MATERIALS

- A. Fire-Retardant-Treated Wood Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements 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. Exterior Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84 after being subjected to accelerated weathering according to ASTM D 2898, 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, transparent, 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 treated woodwork.
- C. Extent of Fire-Retardant-Treated Wood Materials:
 1. Exterior architectural woodwork located more than 40 feet above grade.
 2. Exterior architectural woodwork in locations with a fire-separation distance of 5 feet or less.
 3. **Where indicated on Drawings.**

2.7 MISCELLANEOUS MATERIALS

- A. Nails: **stainless steel**.
- B. Screws: **stainless steel**.
 - 1. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- C. 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.

2.8 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate exterior architectural woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- C. 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 allowance for scribing, trimming, and fitting.

2.9 SHOP PRIMING

- A. Exterior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer as specified in Section 09 9113 "Exterior Painting."
- B. Exterior Architectural Woodwork for Transparent Finish: Shop seal with stain (if required), other required pretreatments, and first coat of finish as specified in Section 09 9300 "Staining and Transparent Finishing."
- C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing exterior architectural woodwork, 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 surfaces installed in contact with concrete or masonry and to end-grain surfaces.**

2.10 SHOP FINISHING

- A. General: Finish exterior architectural woodwork at fabrication shop. 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 exterior architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of exterior architectural woodwork. Apply two coats to end-grain surfaces.
- C. Opaque Finish: Comply with Section 09 9113 "Exterior Painting."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Before installation, condition exterior architectural woodwork to average prevailing humidity conditions at Project site.
- B. Grade: Install exterior architectural woodwork to comply with same grade as item to be installed.
- C. Assemble exterior architectural woodwork and complete fabrication at Project site to the extent that it was not completed in the shop.
- D. Install exterior architectural woodwork 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.
- E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than **96 inches** long except where shorter single-length pieces are necessary.
 - 1. Scarf running joints and stagger in adjacent and related members.
- F. Scribe and cut exterior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- G. Preservative-Treated Wood Materials: Where field cut or drilled, treat cut ends and drilled holes according to AWPA M4.
- H. Fire-Retardant-Treated Wood Materials: Handle, store, and install fire-retardant-treated materials to comply with chemical treatment manufacturer's written instructions.
- I. Anchor exterior architectural woodwork 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 exterior architectural woodwork.
 - 1. For shop-finished items, use filler matching finish of items being installed.
- J. Touch up finishing work specified in this Section after installation of exterior architectural woodwork. Fill nail holes with matching filler where exposed.
 - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

PROJECT NO. 22-136.03
MONTAGUE APS - AGRICULTURAL CLASSROOM AND BARN
MONTAGUE AREA PUBLIC SCHOOLS

EXTERIOR ARCHITECTURAL WOODWORK
06 4013 - 6
JUNE 30, 2026

K. Field Finishing: By owner.

END OF SECTION 06 4013

SECTION 07 7129 - MANUFACTURED ROOF EXPANSION JOINTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1.
2. Aluminum roof expansion joints.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wooden curbs or cants for mounting roof expansion joints.
2. Section 07 7200 "Roof Accessories" for manufactured and prefabricated metal roof curbs.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For roof expansion joints.
- C. Samples: For each exposed product and for each color specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification data.
- B. Product Test Reports: For each fire-barrier provided as part of a roof-expansion-joint assembly, for tests performed by a qualified testing agency.
- C. Sample warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer of roofing membrane.

1.6 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof expansion joints that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: **20]** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.
 - 1. Temperature Change: **120 deg F, ambient; 180 deg F**, material surfaces.

2.2 ALUMINUM ROOF EXPANSION JOINTS

- A. Aluminum Roof Expansion Joint between 2-hour rated firewalls: Factory-fabricated, continuous, waterproof joint cover; consisting of a formed or extruded metal cover secured to extruded aluminum frames, with water-resistant gasketing between cover and frames, and with provision for securing assembly to substrate and sealing assembly to roofing membrane or flashing.
 - 1. Joint Width: 5 inches..
 - 2. Joint Movement Capability: Plus and minus **As indicated on Drawings**.
 - 3. Frame Members: Extruded aluminum configured for sloped roof composed of insulated metal panels and standing seam. as indicated; with exposed finish **as selected by Architect from manufacturer's full range**.
 - 4. Cover: **as recommended by manufacturer**.
 - 5. Corner, Intersection, and Transition Units: Provide factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints.
 - 6. Accessories: Provide splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation.
 - 7. Secondary Seal: Continuous, waterproof membrane within joint and attached to substrate on sides of joint below the cover.
 - a. Drain-Tube Assemblies: Equip secondary seal with drain tubes and seals to direct collected moisture **to exterior-wall expansion joint cover**.
 - b. Thermal Insulation: Fill space above secondary seal with **mineral-fiber blanket** insulation; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84.

8. Fire Barrier: Manufacturer's standard fire barrier for fire-resistance-rated expansion joint system.

B. Materials:

1. Aluminum: ASTM B 209 for sheet and plate, ASTM B 221 for extrusions; alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 - a. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious or preservative-treated wood materials.
 - 1) Two-Coat Fluoropolymer: System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - b. Aluminum Finish Color: **As selected by Architect from manufacturer's full range.**

2.3 MISCELLANEOUS MATERIALS

- A. Adhesives: As recommended by roof-expansion-joint manufacturer.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
 1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.
- C. Mineral-Fiber Blanket: ASTM C 665.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for handling and installing roof expansion joints.
 1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
 2. Install roof expansion joints true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 3. Provide for linear thermal expansion of roof expansion joint materials.
 4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
 5. Provide uniform, neat seams.
 6. Install roof expansion joints to fit substrates and to result in watertight performance.
- B. Directional Changes: Install factory-fabricated units at directional changes to provide continuous, uninterrupted, and watertight joints.
- C. Transitions to Other Expansion-Control Joint Assemblies: Coordinate installation of roof expansion joints with other exterior expansion-control joint assemblies specified in Section 07 9513.16 "Exterior Expansion

Joint Cover Assemblies" to result in watertight performance. **Install factory-fabricated units at transitions between roof expansion joints and exterior expansion-control joint systems.**

- D. Splices: Splice roof expansion joints to provide continuous, uninterrupted, and waterproof joints.
 - 1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.
- E. Fire Barrier: Install fire barrier as required by manufacturer to provide continuous, uninterrupted fire resistance throughout length of roof expansion joint, including transitions and end joints.
- F. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

END OF SECTION 07 7129

SECTION 07 7253 - SNOW GUARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rail-type, seam-mounted snow guards.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include load ratings for brackets.
- B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.
 - 1. Include details of rail-type snow guards.
- C. Sample for Initial Selection: Consisting of manufacturer's color charts showing full range available.
- D. Samples for Verification:
 - 1. Rail-Type Snow Guards: Bracket, 12-inch- long rail, and installation hardware.
 - a. For units with factory-applied finishes, submit manufacturer's standard color selections.
- E. Delegated-Design Submittal: For snow guards, include analysis reports signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Include calculation of number and location of snow guards.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that the engineer is licensed in the state in which the Project is located.
- B. Product Test Reports: For each type of snow guard, for tests performed by a qualified testing agency, indicating load at failure of attachment to roof system identical to roof system used on this Project.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design snow guards, including attachment to roofing material and roof deck, applicable for attachment method, based on the following:

1. Roof snow load.
 2. Snow drifting
 3. Roof slope.
 4. Roof type.
 5. Roof dimensions.
 6. Roofing substrate type and thickness.
 7. Snow guard type.
 8. Snow guard fastening method and strength.
 9. Snow guard spacing.
 10. Coefficient of Friction Between Snow and Roof Surface: 0.
 11. Factor of Safety: 2.
- B. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- C. Structural Performance: Snow guards shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
1. Snow Loads: As indicated on Drawings.

2.2 RAIL-TYPE SNOW GUARDS

- A. Rail-Type, Seam-Mounted Snow Guards:
1. Basis-of-Design Product: Subject to compliance with requirements, provide S-5!; X-Gard 2.0 or comparable product by one of the following:
 - a. Alpine SnowGuards; a division of Vermont Slate & Copper Services, Inc.
 - b. LMCurbs.
 - c. Metal Roof Innovation, Ltd.; S-5! Attachment Solutions.
 - d. Snow Management Systems; a division of Contek, Inc.
 - e. TRA-MAGE, Inc.
 - 2.
 3. Description: Snow guard rails fabricated from metal pipes, bars, or extrusions, anchored to brackets and equipped with two rails.
 4. Bars: ASTM B221 aluminum, clear anodized.
 5. Seam clamps: ASTM B221 aluminum extrusion or ASTM B85/B85M aluminum casting with stainless steel set screws incorporating round nonpenetrating point; designed for use with applicable roofing system to which clamp is attached.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install snow guards according to manufacturer's written instructions.

1. Space rows as indicated on Shop Drawings.
- B. Attachment for Standing-Seam Metal Roofing:
 1. Rail-Type, Seam-Mounted Snow Guards:
 - a. Install brackets to vertical ribs in straight rows.
 - b. Secure with stainless steel set screws, incorporating round nonpenetrating point, on same side of standing seam.
 - c. Torque set screw according to manufacturer's instructions.
 - d. Install cross members to brackets.

END OF SECTION 07 7253

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SECTION 07 8443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated construction.

B. Related Requirements:

1. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.
2. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Listed System Designs: For each joint firestopping system, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.6 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until building inspector of authorities having jurisdiction have examined each installation.
- C. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with Listed System Designs published by a qualified testing agency.
 - 1) UL in its online directory "Product iQ."
 - 2) Intertek Group in its "Directory of Building Products."

2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
 - 1. Provide products that, upon curing, do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
 - 2. Provide firestop products that do not contain ethylene glycol.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Building and Construction.
 - b. A/D Fire Protection Systems Inc.
 - c. Balco; a CSW Industrials Company.
 - d. CEMCO; California Expanded Metal Products Co.
 - e. ClarkDietrich.
 - f. Everkem Diversified Products, Inc.
 - g. Grabber Construction Products, Inc.
 - h. Hilti, Inc.
 - i. International Fireproof Technology Inc.
 - j. Marino\WARE.
 - k. NUCO Inc.
 - l. Nelson; Emerson Electric Co., Automation Solutions.
 - m. Owens Corning.
 - n. Passive Fire Protection Partners.
 - o. ROCKWOOL.
 - p. Specified Technologies, Inc.
 - q. Tremco Incorporated.
 - r. Willseal LLC. (Tremco)
 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Building and Construction.
 - b. A/D Fire Protection Systems Inc.
 - c. Balco; a CSW Industrials Company.
 - d. CEMCO; California Expanded Metal Products Co.
 - e. Everkem Diversified Products, Inc.
 - f. Hilti, Inc.
 - g. International Fireproof Technology Inc.
 - h. Marino\WARE.
 - i. NUCO Inc.
 - j. Nelson; Emerson Electric Co., Automation Solutions.
 - k. Owens Corning.
 - l. Passive Fire Protection Partners.
 - m. Polyset.
 - n. ROCKWOOL.
 - o. Specified Technologies, Inc.
 - p. Tremco Incorporated.
 - q. Willseal LLC.
 2. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.
- D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

2.3 ACCESSORIES

- A. Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- C. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- D. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
 - 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 - 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

- A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing agency.
 - 4. Date of installation.

5. Manufacturer's name.
6. Installer's name.

3.3 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections in accordance with ASTM E2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.4 JOINT FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's online directory "Product iQ" under product Category XHBN . Manufacturer's fire protection engineer shall review compliance of the systems below, or any proposed substitute, with the specific project conditions and applicable codes.
- B. Head-of-Wall, Fire-Resistive Joint Firestopping Systems: At the top of each fire-rated concrete or masonry wall to metal roof construction, provide the following:
 1. UL-Classified Systems: HW-D-0086, STI, Basis of Design
 2. Nominal Joint Width: 1.5 inch to 2 inch .
 3. Movement Capabilities: Class II - 40 to 50 percent compression or extension to allow 3/4 inch movement up and down..
- C. Head-of-Wall, Fire-Resistive Joint Firestopping Systems: At the top of each fire-rated gypsum board wall, provide the following:
 1. UL-Classified Systems: HW-D-0032, HW-D-0033, HW-D-0042.
 2. Nominal Joint Width: 1 inch
 3. Movement Capabilities: Class II - 50 percent compression or extension, 1/2 inch movement up or down.

END OF SECTION 07 8443

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SECTION 07 9100 - PREFORMED JOINT SEALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes preformed, foam joint seals.
 - 1. Preformed, foam joint seals.
- B. Related Requirements:
 - 1. Section 07 9200 "Joint Sealants" for liquid sealants applied over preformed seals in dual seal systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each preformed joint seal product.
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each type and color of preformed joint seal required, provide Samples with joint seals in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint seals.
- D. Preformed joint seal schedule.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranties.

1.4 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace preformed joint seals that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: **Two** years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish preformed joint seals to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PREFORMED, FOAM JOINT SEALS

- A. Preformed, Foam Joint Seals between 2-hour rated firewalls: Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. EMSEAL Joint Systems, Ltd.
 - b. LymTal International Inc.
 - c. MM Systems Corporation.
 - d. Nystrom, Inc.
 - e. Sandell Manufacturing Co., Inc.
 - f. Schul International Company, Inc.
 - g. Watson Bowman Acme Corp.
 2. Design Criteria:
 - a. Nominal Joint Width: **As indicated on Drawings.**
 - b. \
 - c. Movement Capability: **As indicated on Drawings.**
 3. Joint Seal Color: **As selected by Architect from full range of industry colors.**

2.2 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by preformed-joint-seal manufacturer for joint substrates indicated.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to preformed joint seal manufacturer, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces, and formulated to promote best adhesion to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with preformed joint seals and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing preformed joint seals to comply with preformed joint seal manufacturer's written instructions and the following requirements:
1. Remove laitance and form-release agents from concrete.
 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.

- B. Joint Priming: Prime joint substrates where recommended by preformed joint seal manufacturer or as indicated by tests or prior experience.
- C. Masking Tape: Use masking tape where required to prevent contact of adhesive or primer with adjoining surfaces.

3.2 INSTALLATION

- A. General: Comply with preformed joint seal manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Installation of Preformed, Foam Joint Seals:
 - 1. Install each length of seal immediately after removing protective wrapping.
 - 2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
 - 3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
 - 4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.
- C. Installation of Precured, Extruded-Silicone Joint Seals:
 - 1. Apply masking tape to each side of joint, outside of area to be covered by seal system.
 - 2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone seal system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
 - 3. Press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact with substrate.
 - 4. Complete installation of seal system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

END OF SECTION 07 9100

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SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Immersible joint sealants.
4. Mildew-resistant joint sealants.
5. Butyl joint sealants.
6. Latex joint sealants.

B. Related Requirements:

1. Section 07 9219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
2. Section 32 1373 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Preconstruction laboratory test reports.

C. Preconstruction field-adhesion-test reports.

D. Field-adhesion-test reports.

- E. Sample warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range unless indicated otherwise.
 - 1. Provide custom colors to match Architect's samples for silicone sealant with less than 20 color selections available.
 - 2. Provide multiple sealant colors for each material that the sealant is adjacent to.

2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 756 SMS.
 - b. Sika Corporation; Sikasil WS-295 FPS.
 - c. Tremco Incorporated; Spectrem 3.
- C. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Tremco Incorporated; Spectrem 4-TS.

2.3 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc; Chem-Calk 2000.
 - b. Pecora Corporation; Dynatrol I-XL.
 - c. Polymeric Systems, Inc; Flexiprene 1000.
 - d. Sherwin-Williams Company (The); Stampede-1.
 - e. Tremco Incorporated; Dymonic.
- B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Polymeric Systems, Inc; Flexiprene 952.
 - b. Sherwin-Williams Company (The); Stampede 1SL.

2.4 IMMERSIBLE JOINT SEALANTS

- A. Urethane, Immersible, S, NS, 25, T, NT, I: Immersible, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Uses T, NT, and I.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Tremco Incorporated; Vulkem 45 SSL.

2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT, White: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 786-M White.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
 - c. Tremco Incorporated; Tremsil 200.
- C. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT, Clear: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 999-A.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.

- c. Tremco Incorporated; Tremsil 200.

2.6 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc; Chem-Calk 300.
 - b. Pecora Corporation; BC-158.

2.7 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Construction Chemicals - Construction Systems; MasterSeal NP 520.
 - b. Pecora Corporation; AC-20.
 - c. Sherwin-Williams Company (The); 950A Siliconized Acrylic Latex Caulk.
 - d. Tremco Incorporated; Tremflex 834.

2.8 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove laitance and form-release agents from concrete.
 - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.3 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces <**JS-#1**>.

1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precast architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints in dimension stone cladding.
 - e. Joints in glass unit masonry assemblies.
 - f. Joints in exterior insulation and finish systems.
 - g. Joints between metal panels.
 - h. Joints between dissimilar materials.
 - i. Perimeter joints between exterior wall construction and frames of **storefront framing, doors, windows, and louvers**.
 - j. Control and expansion joints in **ceilings and other overhead surfaces**.
 - k. Other joints as indicated on Drawings.
2. Joint Sealant: One of the following:
 - a. Silicone, nonstaining, S, NS, 50, NT.
 - b. Silicone, nonstaining, M, NS, 50, NT.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces <**JS-#2**>.

1. Joint Locations:
 - a. Perimeter joints of exterior openings.
2. Joint Sealant: One of the following:
 - a. Silicone, nonstaining, S, NS, 50, NT.
 - b. Silicone, nonstaining, M, NS, 50, NT.

C. Joint-Sealant Application: Exterior and interior joints in surfaces subject to water immersion <**JS-#3**>.

1. Joint Locations:
 - a. Other joints as indicated on Drawings.
2. Joint Sealant: Urethane, immersible, S, NS, 25, T, NT, I.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces <**JS-#4**>.

1. Joint Locations:
 - a. Isolation joints in exposed cast-in-place concrete slabs.
 - b. Other joints as indicated on Drawings.
2. Joint Sealant: Urethane, S, P, 25, T, NT.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces <**JS-#5**>.

1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of **unit masonry concrete walls**[and partitions.
 - d. Other joints as indicated on Drawings.
 2. Joint Sealant: Urethane, S, NS, 25, NT.
- F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement <**JS-#6**>.
1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of **interior doors** and **windows** .
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Acrylic latex.
- G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces <**JS-#7**>.
1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Other joints as indicated on Drawings.
 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT, white.
 3. Joint-Sealant Color: White.
- H. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces <**JS-#8**>.
1. Joint Locations:
 - a. Joints between countertops and backsplashes.
 2. Joint Sealant: Silicone, mildew resistant, acid curing, clear, S, NS, 25, NT.
 3. Joint-Sealant Color: Clear.
- I. Joint-Sealant Application: Concealed mastics <**JS-#9**>.
1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Butyl-rubber based.

END OF SECTION 07 9200

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SECTION 07 9219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical joint sealants.
- B. Related Requirements:
 - 1. Section 07 9200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.2 ACTION SUBMITTALS

- A. Product Data: For each acoustical joint sealant.
 - 1. Laboratory Test Reports for Credit IEQ 4: For sealants and sealant primers used inside the weatherproofing system, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Acoustical-Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.
- B. VOC Content of Interior Sealants: Sealants and sealant primers shall comply with the following:
 - 1. Acoustical sealants and sealant primers shall have a VOC content of [250] <Insert value> g/L or less.

- C. Low-Emitting Interior Sealants: Acoustical sealants and sealant primers shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.; RCS20 Acoustical.
 - b. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Tremco Incorporated; Acoustical Sealant 30CTG.
 - e. United State Gypsum Company; Sheetrock Acoustical Sealant.
- B. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- C. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- D. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

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END OF SECTION 07 9219

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SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Interior standard steel doors and frames.
- B. Related Requirements:
 - 1. Section 08 7100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
- D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ceco Door; ASSA ABLOY.
 - 2. Curries Company; ASSA ABLOY.
 - 3. Fleming Door Products Ltd.; Assa Abloy Group Company.
 - 4. Steelcraft; an Allegion brand.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings **and temperature-rise limits** indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide assemblies with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
 - 2. Temperature-Rise Limit: **Where indicated**, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; SDI A250.4, Level B.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard.
 - f. Fire-Rated Core: Manufacturer's standard vertical steel stiffener core for fire-rated **[and temperature-rise-rated]**doors.
 - 2. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
 - b. Construction: Face welded.
 - 3. Exposed Finish: Prime.

2.4 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
 - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.

2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

- D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- E. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- F. Glazing: Comply with requirements in Section 08 8000 "Glazing."

2.6 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. [
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
 - 2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 - 3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.7 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 - 2. Fire-Rated Openings: Install frames according to NFPA 80.
 - 3. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 4. Solidly pack mineral-fiber insulation inside frames. For framed construction.
 - 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces. For existing in-place construction prior to commencement of construction.
 - 6. In-Place Metal or Wood-Stud Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

- a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 CLEANING AND TOUCHUP

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 08 1113

SECTION 08 1243 - FIRE-RESISTANCE-RATED FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes frames for glazing **and doors** capable or resisting fire and the transfer of radiant heat.
- B. Related Sections:
 - 1. Section 08 1113 "Hollow Metal Doors and Frames" for non-fire-rated and fire-protection-rated **doors and** frames of steel construction.

1.2 DEFINITIONS

- A. Fire-Protection-Rated Assemblies: Assemblies consisting of rated framing, doors, and openings up to 45 minutes, limited in size, and not capable of blocking radiant heat.
- B. Fire-Resistance-Rated Assemblies: Assemblies consisting of rated framing, doors, and openings that prevents spread of fire and smoke and radiant heat; used in rated wall and door applications 60 minutes and above without size limitations.

1.3 COORDINATION

- A. Coordinate anchorage installation for fire-resistance-rated frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Environmental product declarations for fire-resistance-rated frames.
- C. Shop Drawings: Include frame details for each frame type, including dimensioned profiles and metal thicknesses.

- D. Product Schedule: For fire-resistance-rated frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-resistance-rated frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames that include doors with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store fire-resistance-rated frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Assemblies: Listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings **and temperature-rise limits** indicated, based on testing as an assembly complying with ASTM E119 or UL 263.
 - 1. Smoke- and Draft-Control Assemblies: Provide assemblies with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
 - 2. Temperature-Rise Limit: , provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

2.2 FIRE-RESISTANCE-RATED FRAMES

- A. Fire-Resistance-Rated Frames: Steel or aluminum frames with proprietary intumescent fire-resistant materials as follows:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aluflam North America; Fire Rated Aluminum Storefront Vision Walls
 - b. Curries Company; ASSA ABLOY; Contraflam.
 - c. SAFTI FIRST Fire Rated Glazing Solutions; GPX Architectural Series.
 - d. Technical Glass Products; Fireframes Heat Barrier Series.
 - 2. Fire Rating: As indicated on Drawings.
 - 3. Finish: Primed for field painting.

2.3 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

2.4 FABRICATION

A. Fire-Resistance-Rated Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing frames for hardware.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. General: Install fire-resistance-rated frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Fire-Resistance-Rated Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
2. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
4. In-Place Metal or Wood-Stud Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
5. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 CLEANING AND TOUCHUP

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 08 1243

SECTION 08 3323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulated service doors.

B. Related Requirements:

1. Section 05 5000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
2. Show locations of controls, locking devices detectors or replaceable fusible links, and other accessories.
3. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Cookson Company.
 - 2. Cornell Iron Works, Inc.
 - 3. Overhead Door Corporation.
 - 4. Raynor.
 - 5. Wayne-Dalton Corp.

- B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

- 1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
- B. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
 - 1. Design Wind Load: **As indicated on Drawings.**
 - 2. Testing: According to ASTM E 330/E 330M.
 - 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

2.3 DOOR ASSEMBLY

- A. **Insulated Service** Door (105B, 105C and 105D): Overhead coiling door formed with curtain of interlocking metal slats.

1. Operation Cycles: Door components and operators capable of operating for not less than **20,000**.
2. Air Infiltration: Maximum rate of **1.0 cfm/sq. ft.** at 15 and 25 mph when tested according to **ASTM E 283**.
3. Curtain R-Value: **6.0 deg F x h x sq. ft./Btu.**
4. Door Curtain Material: Aluminum.
5. Door Curtain Slats: Flat profile slats of **1-7/8-inch3-1/4-inch** center-to-center height.
 - a. Vision Panels: Approximately 10- by 1-5/8-inch openings spaced approximately 2 inches apart and beginning 12 inches from end guides; in two rows of slats; installed with insulated vision-panel glazing.
 - b. Insulated-Slat Interior Facing: **Metal**.
 - c. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
6. Bottom Bar: Two angles, each not less than **1-1/2 by 1-1/2 by 1/8 inch** thick; fabricated from aluminum extrusions and finished [to match door.
7. Curtain Jamb Guides: **Aluminum** with exposed finish matching curtain slats.
8. Hood: Match curtain material and finish.
 - a. Mounting: Face of wall.
9. Locking Devices: Equip door with locking device assembly.
 - a. Locking Device Assembly: Single-jamb side locking bars, operable from inside with thumbturn.
10. Electric Door Operator:
 - a. Usage Classification: [Medium duty, up to 12 cycles per hour and up to 50 cycles per day
 - b. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; **moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower**.
 - c. Motor Exposure: Interior.
 - d. Motor Electrical Characteristics: Match building electrical system.
 - e. Emergency Manual Operation: **Chain** type.
 - f. Obstruction-Detection Device: Automatic photoelectric sensor>.
 - g. Control Station(s): Where indicated on Drawings.
11. Curtain Accessories: Equip door with weatherseals.
12. Door Finish:
 - a. Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
 - b. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face Finish as selected by Architect from manufacturer's full range.
13. Door 106A: Provide an overhead coiling overhead door for the chickens with all the same specifications as the other overhead coiling doors except DO NOT provide a vision panel.

2.4 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Aluminum Door Curtain Slats: ASTM B 209 sheet or ASTM B 221 extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch; and as required.
 2. Vision-Panel Glazing: Manufacturer's standard clear glazing, fabricated from transparent acrylic sheet or fire-protection-rated glass as required for type of door; set in glazing channel secured to curtain slats.
 3. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
 4. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with **minimum aluminum thickness of 0.032 inch**.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.6 [HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.
 2. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.
- B. Removable Metal Soffit: Formed or extruded from same metal and with same finish as curtain if hood is mounted above ceiling unless otherwise indicated.

2.7 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
1. Lock Cylinders: As **specified in Section 08 7100 "Door Hardware"**.
 2. Keys: **Three** for each cylinder.

- C. Chain Lock Keeper: Suitable for padlock.
- D. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 CURTAIN ACCESSORIES

- A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8-inch- thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, **flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.**
- B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
- C. Pull-Down Strap: Provide pull-down straps for doors more than 84 inches high.
- D. Poll Hooks: Provide pole hooks and poles for doors more than 84 inches high.
 - 1. Automatic Reset: Coiling fire door system shall be capable of being tested and reset without the need for ladders, tools or special training; including testing power failure and alarm scenarios. Include a test key-switch, when activated, that will cut power and simulate alarm system activation (open dry-contacts), and cause the operator's brake mechanism to open and the door to close at a safe and consistent close speed not to exceed 12 inches per second. The system shall not include cables, pulleys, separate release devices, or mechanical test handles.

2.9 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.10 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Motors: Reversible-type motor[**with controller (disconnect switch)**] for motor exposure indicated for each door assembly.
 - 1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 - 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- D. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- E. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. **For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.**
 - 1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained or constant pressure on close button.
- F. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 - 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 - 2. Exterior-Mounted Units: Full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- G. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed **30 lbf**.
- H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.11 FINISH REQUIREMENTS

- A. General: Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
 - 1. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Aluminum Finishes:
 - 1. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 2. [

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Power-Operated Doors: Install **automatic garage doors openers** according to UL 325.

3.2 STARTUP SERVICE

- A. Startup Service: Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
 - 3. Test door closing when activated by detector or alarm-connected automatic-closing system. Reset door-closing mechanism after successful test.
- B. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather resistant.
 - 2. Lubricate bearings and sliding parts as recommended by manufacturer.
 - 3. Adjust seals to provide tight fit around entire perimeter.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08 3323

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SECTION 08 3483 - FLOOR DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes floor doors.
- B. Related Requirements:

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Floor Doors: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency according to NFPA 288.

2.2 ALUMINUM FLOOR DOORS

- A. Angle Frame Aluminum Floor Door:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Babcock-Davis.
 - b. Bilco Company (The).
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - e. Nystrom, Inc.
 - f. Williams Bros. Corporation of America (The).
 - 2. Frame: Mill finish aluminum, angle profile.
 - 3. Door: **Single** leaf; 1/4-inch-thick, **smooth** mill-finish aluminum plate.
 - 4. Loading Capacity: **300-lbf/sq. ft. pedestrian live load.**
 - 5. Hardware:
 - a. Material and Finish: **Type 316 stainless steel, including latch and lifting mechanism assemblies, hold-open arms, and brackets, hinges, pins, and fasteners.**
 - b. Hinges: Heavy-duty butt hinges with stainless-steel pins.
 - c. Operating Mechanism: Adjustable counterbalancing springs, heavy-duty hold-open arm that automatically locks door open at 90 degrees, release handle with vinyl grip that allows for one-handed closure, and recessed lift handle.
 - d. Latch: Stainless-steel slam latch.
 - e. Lock: To be determined.

- B. Safety Accessories: Safety [chains] [net] [railing] [telescoping safety post] [grid] <Insert safety device>.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
- C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- D. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- E. Rolled-Stainless Steel Floor Plate: ASTM A793, manufacturer's standard finish.
- F. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666. Remove tool and die marks and stretch lines, or blend into finish.
- G. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- H. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
- I. Aluminum Sheet: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- J. Frame Anchors: Same material as door face.
- K. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.4 FABRICATION

- A. General: Provide floor doors manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure floor doors to types of supports indicated.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. For cylinder locks, furnish two keys per lock and key all locks alike.
 - 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

- E. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that comes in contact with concrete.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
- E. Prime Painted Steel: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
- F. Stainless Steel Finish: Bright, cold-rolled, unpolished ASTM A480/A480M No. 2B finish.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor doors.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 3483

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SECTION 08 4113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed entrance and storefront systems.

B. Related Requirements:

1. Section 019119.43 "Exterior Enclosure Commissioning" for additional field quality control testing requirements.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include plans, elevations, sections, full-size details, and attachments to other work.
2. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
3. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrance and storefront systems, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
4. Include connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
5. Include point-to-point wiring diagrams showing the following:
 - a. Power requirements for each electrically operated door hardware.
 - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.
6. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Energy Performance Certificates: For aluminum-framed entrance and storefront systems, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront system.
- C. Field Quality Control Reports: For specified tests and inspections.
- D. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Contracts: For maintenance service agreement.
- B. Operation and Maintenance Data: For aluminum-framed entrance and storefront systems.
- C. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront. Include ASTM C1401 recommendations for post-installation-phase quality-control program.
- D. Warranty Documentation: For specified special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- C. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of storefront systems that include structural glazing.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's written approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.6 WARRANTY

- A. Special Warranty: **Manufacturer** agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures, including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, **metal finishes**, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
1. Wind Loads: As indicated on Drawings.

- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
1. Deflection Normal to Wall Plane: Limited to **1/175 of length of span of the framing member for lengths of up to 13 ft. 6 inches and to 1/240 of length of span of the framing member plus 1/4 inch for lengths greater than 13 ft. 6 inches** Insert deflection limit.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than **1/8 inch**.
 - a. Operable Units: Provide a minimum **1/16-inch** clearance between framing members and operable units.
 3. Cantilever Deflection: Limited to 2l/175 at unsupported cantilevers.
- E. Structural: Test according to ASTM E 330/E 330M as follows:
1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than **10 lbf/sq. ft.**
- G. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than **0.35 Btu/sq. ft. x h x deg F** as determined according to NFRC 100.
-
2. Solar Heat-Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than **0.35** as determined in accordance with ANSI/NFRC 200.
-
- b.
3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested according to ASTM E283.
 - b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
 4. Condensation Resistance Factor (CRF):

- a. Fixed Glazing and Framing Areas: CRF for the system of not less than 59 as determined in accordance with AAMA 1503.

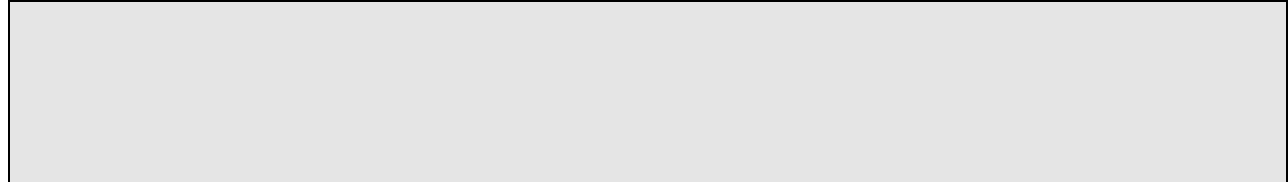


- H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- I. Structural-Sealant Joints:
 1. Designed to carry gravity loads of glazing.
- J. Structural Sealant: ASTM C 1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed, aluminum-framed entrances and storefronts without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
 1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 1. Basis-of-Design Product: Kawneer Company, Inc.; Arconic Corporation; 601UT.
 - a. **[EFCO Corporation; Architectural Metals; Apogee Enterprises, Inc.]**
 - b. **[Kawneer Company, Inc.; Arconic Corporation]**
 - c. **[OldCastle BuildingEnvelope (OBE)]**
 - d. **[Pittco Architectural Metals, Inc.]**
 - e. **[Tubelite Inc.; Architectural Metals; Apogee Enterprises, Inc.]**
 - f. **[U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - g. **[YKK AP America Inc.]**
 - h. **<Insert manufacturer's name>**
 2. Frame Profile: 2 inches wide by 5 inches deep.
 3. Exterior Framing Construction: Double thermally broken.
 4. Interior Vestibule Framing Construction: Nonthermal.
 5. Glazing System: Retained mechanically with gaskets on four sides.
 6. Glazing Plane: Front-set.
 7. Finish: **Color anodic finish.**
 8. Fabrication Method: Field-fabricated stick system.

9. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 10. Steel Reinforcement: As required by manufacturer.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.



2.3 ENTRANCE DOOR SYSTEMS

- A. Stile-and-Rail Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cross Aluminum Products, Inc.
 - b. EFCO Corporation.
 - c. Kawneer.
 - d. Oldcastle Building Envelope.
 - e. Tubelite Inc.
 - f. United States Aluminum.
 - g. YKK AP America Inc.
 2. Door Construction: **1-3/4-inch overall thickness, with minimum 0.125-inch-thick**, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: **High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.**
 - b. Thermal Transmittance (U-factor): Not more than 0.65 Btu/sq. ft. x h x deg F as determined according to NFRC 102.
 - c. Condensation Resistance: Condensation rating of not less than 46 as determined according to AAMA 1503.
 3. Door Design: **As indicated on Drawings**
 4. Glazing Stops and Gaskets: **Square**, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
- B. Aluminum Skin Doors (ALSN): Aluminum skins rabbeted into extruded aluminum frames with poured in placed insulation core as follows:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Aluminum and Glass
 - b. Cline Aluminum Doors Inc.
 - c. CMI Architectural Products, Inc.

- d. Commercial Door Systems
 - e. Special-Lite, Incorporated
 - f. United States Aluminum
- 2. Frames: Extruded 6063-T5 aluminum alloy rails and stiles, 1-3/4 inches deep and minimum 2-5/16 inches wide, with 0.125-inch thick walls. Construct with mitered corners and provide joinery of 3/8-inch diameter full width tie rods through extruded splines top and bottom. Reinforce to accept hardware as specified. Provide hex type aircraft nuts for joinery without welds, glues or other methods for securing internal door extrusions. Furnish integral reglets to accept face sheet to permit a flush appearance. Rail caps or other face sheet capture methods are not acceptable. Extrude top and bottom rail legs for interlocking continuous rail rigidity weather bar. Lock face sheet material in place with extruded interlocking edges to be flush with aluminum rails and stiles.
 - 3. Aluminum Facing Sheets: 0.062-inch-thick aluminum sheet with smooth surface and manufacturer's backing sheet.
 - 4. Core of Door Assembly: Minimum 5 lb./cu. ft. density poured-in-place polyurethane free of CFC. Minimum "R" value of 11. Meeting stiles on pairs of doors and bottom weather bars with nylon brush weatherstripping.
 - 5. Manufacture doors with cutouts for vision lites, louvers or panels as indicated. Factory furnish and install all glass, louvers and panels prior to shipment.
 - 6. Pre-machine doors in accordance with templates from the specified hardware manufacturers and approved hardware schedule.
 - 7.

2.4 [.]ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 7100 "Door Hardware."
- B. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- C. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Made of ASTM D 2000 molded neoprene or ASTM D 2287 molded PVC.
 - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- D. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- E. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.5 GLAZING

- A. Glazing: Comply with Section 08 8000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.

- D. Structural Glazing Sealants: ASTM C 1184 chemically curing silicone formulation that is compatible with system components with which it comes in contact; specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.

1. Color: **As selected by Architect from manufacturer's full range of colors.**

- E. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

1. Color: Match structural sealant.

2.6 MATERIALS

- A. Sheet and Plate: ASTM B 209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
- C. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
- D. Structural Profiles: ASTM B 308/B 308M.
- E. Steel Reinforcement:
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
 4. Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.7 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.
- B. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.
- C. Joint Sealants and Backings: Provide joint sealants, backings, and other related materials in accordance with Section 079200 "Joint Sealants."

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. Door Stops: Screw-applied or snap-in box type with minimum 3/4-inch depth.
 - 2. At interior and exterior doors, provide compression weather stripping at fixed stops.
- G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1.
 - 2. Color: **As selected by Architect from full range of industry colors and color densities.**

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Joint Sealants and Backings: Install in accordance with Section 079200 "Joint Sealants."

1. Set continuous sill members and flashing in full sealant bed.
2. Seal perimeter of framing members with sealant.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Glazing: Install glazing as specified in Section 088000 "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.2 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on **representative areas of aluminum-framed entrances and storefronts**.
1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of **two** tests in areas as directed by Architect.
- C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 MAINTENANCE SERVICE

- A. Entrance Door Hardware Maintenance:
1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

- B. Initial Maintenance Service: Beginning at Substantial Completion, provide **[six]<Insert number>** months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting

**PROJECT NO. 22-136.03
MONTAGUE APS - AGRICULTURAL CLASSROOM AND BARN
MONTAGUE AREA PUBLIC SCHOOLS**

**ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
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as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are manufacturer's authorized

END OF SECTION 08 4113

SECTION 08 8000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass products.
 - 2. Laminated glass.
 - 3. Insulating glass.
 - 4. Glazing sealants.
 - 5. Miscellaneous glazing materials.

- B. Related Requirements:

1.2 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- C. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturers of fabricated glass units.
- B. Product Certificates: For glass.
- C. Product test reports.

1.5 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

- B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.
- C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain tinted glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design glazing.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 - 1. Design Wind Pressures: Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - b. Basic Wind Speed: 90 mph.
 - c. Importance Factor: 1.0.
 - d. Exposure Category: B.
 - 2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - 3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
 - 2. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
 - 3. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 2. AAMA Publications: AAMA GD5G-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- D. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.

2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary sealants.
 2. Perimeter Spacer: Nonmetallic laminate or nonmetallic tube, black color.

2.7 GLAZING SEALANTS

- A. General:
1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Field-applied sealants shall have a VOC content of not more than 250 g/L.
 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- B. Neutral-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. May National Associates, Inc.; a subsidiary of Sika Corporation; Bonaflex Sil 201 FC.
 - b. Polymeric Systems, Inc.; PSI-631.
 - c. Tremco Incorporated; Tremsil 600.
 2. Applications: Interior glazing.
- C. Acid-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1000 Contractors.
 - b. Pecora Corporation; 860.
 - c. Polymeric Systems, Inc.; PSI-601.
 - d. Sika Corporation; Sikasil-GP,
 - e. The Dow Chemical Company; 999-A.
 - f. Tremco Incorporated; Proglaze.
 2. Applications: Interior butt glazing.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- B. Setting Blocks:

1. Elastomeric material with Shore A durometer hardness of 85, plus or minus 5.
 2. Type recommended in writing by sealant or glass manufacturer.
- C. Spacers:
1. Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 2. Type recommended in writing by sealant or glass manufacturer.
- D. Edge Blocks:
1. Elastomeric material with Shore A durometer hardness per manufacturer's written instructions.
 2. Type recommended in writing by sealant or glass manufacturer.
- E. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.2 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.3 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel

and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.4 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.

3.5 INSULATING GLASS SCHEDULE

- A. Low-E-Coated, Clear Insulating Glass Type (IG-1):
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Minimum Thickness of Each Glass Lite: 6 mm.
 - 3. Outdoor Lite: Fully tempered float glass.
 - 4. Interspace Content: Argon.
 - 5. Indoor Lite: Fully tempered float glass.
 - 6. Captured Low-E Coating: Sputtered on second surface.
 - a. Products: One of the following:
 - 1) AGC Glass Company North America; Energy Select 40.
 - 2) Guardian Industries Corp., Sunguard; SN 68.
 - 3) Viracon, Inc.; VE 1-2M.
 - 4) Vitro Architectural Glass, Inc.; Solarban 60.
 - 7. Exposed Low-E Coating: Sputtered on fourth surface.
 - a. Products: One of the following:
 - 1) AGC Glass Company North America; U4.
 - 2) Cardinal Glass Industries; LoE-i81.
 - 3) Guardian Industries Corp.; Sunguard IS 20.
 - 8. Winter Nighttime U-Factor: 0.20 maximum.
 - 9. Summer Daytime U-Factor: 0.18 maximum.
 - 10. Visible Light Transmittance: 60 percent minimum.
 - 11. Solar Heat Gain Coefficient: 0.36 maximum.
 - 12. Safety glazing required.

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SECTION 08 9119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fixed extruded-aluminum louvers.
 - 2. Blank-off panels for louvers
- B. Related Requirements:

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
- C. Samples for Verification: For each type of metal finish required.

1.3 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M.

1.4 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.5 WARRANTY

- A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **20** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.2 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Drainable-Blade Louver **<Insert drawing designation>**:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. All-Lite Architectural Products.
 - b. American Warming and Ventilating; a Mestek Architectural Group company.
 - c. Arrow United Industries.
 - d. Construction Specialties, Inc.
 - e. Greenheck Fan Corporation.
 - f. Industrial Louvers Inc.
 - g. Ruskin Company.
 - 2. Louver Depth: **4 inches**, coordinate with depth of insulated metal panels..
 - 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
 - 4. Louver Performance Ratings:
 - a. Free Area: Not less than 8.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
 - b. Point of Beginning Water Penetration: Not less than 1000 fpm.
 - c. Air Performance: Not more than 0.10-inch wg static pressure drop at 700-fpm free-area intake velocity.
 - 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.3 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Bird screening.

- B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.
- C. Louver Screening for Aluminum Louvers:
 - 1. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inch wire.

2.4 BLANK-OFF PANELS

- A. Insulated Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.
 - 1. Thickness: 2 inches.
 - 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
 - 3. Insulating Core: Extruded-polystyrene foam.
 - 4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch nominal thickness, with corners mitered and with same finish as panels.
 - 5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
 - 6. Panel Finish: **Same finish applied to louvers.**
 - 7. Attach blank-off panels with sheet metal screws.

2.5 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use **tamper-resistant** screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E 488/E 488M conducted by a qualified testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.6 FABRICATION

- A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- B. Maintain equal louver blade spacing to produce uniform appearance.

- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: **Channel** unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.
 - 1. Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades, so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
- F. Provide subsills made of same material as louvers for recessed louvers.
- G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 FINISHES

- A. Aluminum Finishes:
 - 1. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with **AAMA 2604** and containing not less than **[50] [70]** percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: **As selected by Architect from manufacturer's full range.**

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- D. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- E. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 9200 "Joint Sealants" for sealants applied during louver installation.

3.2 ADJUSTING

- A. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION 08 9119

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SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.

B. Related Requirements:

1. Section 05 4000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation reports for firestop tracks.

1.4 QUALITY ASSURANCE

- A. 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 or the Steel Stud Manufacturers Association**.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C 645.
 - 1. Steel Studs and Tracks:
 - a. Minimum Base-Metal Thickness: **0.0296 inch**.
 - 1) For head runner, sill runner, jamb, and cripple studs at openings, provide framing of minimum 0.033 inch.
 - 2) For studs supporting **[ceramic tile] [or] [impact-resistant gypsum board] [abuse-resistant gypsum board]**, provide framing of minimum 0.033 inch.
 - b. Depth: 3-5/8 inches unless indicated otherwise.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Single Long-Leg Track System: ASTM C 645 top track with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 - 2. Double-Track System: ASTM C 645 top outer tracks, inside track with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
 - 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) BlazeFrame Industries; Bare Slotted Track (BST/BST 2).
 - 2) CEMCO; California Expanded Metal Products Co.; CST Slotted Deflection Track.
 - 3) ClarkDietrich Building Systems; SLP-TRK Slotted Deflection Track.
 - 4) Metal-Lite; The System.
 - 5) Steel Network, Inc. (The); VertiTrack VT.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BlazeFrame Industries; Intumescent Framing, Fire Stop System.
 - b. CEMCO; California Expanded Metal Products Co.; FAS Track.
 - c. ClarkDietrich Building Systems; BlazeFrame.
 - d. Fire Trak Corp; Fire Trak System attached to studs with Fire Trak Posi Klip.
 - e. Metal-Lite; The System.
 - f. Perfect Wall, Inc.; The System Slotted Deflection Track.
 - g. Steel Network, Inc. (The); VertiTrack VT.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: **0.0329 inch**.
2. Depth: 7/8 inch unless indicated otherwise.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
 1. Depth: 1-1/2 inches.
- E. Furring Channels (Furring Members):
 1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base-Metal Thickness: **0.0329 inch**.
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; 640/660 Drywall Ceiling Suspension.
 - c. United State Gypsum Company; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.
 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754 and AISI S200.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
 1. Install bracing on uncovered side of studs at walls covered on one side only at 48 inches on center maximum.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 1. Spacing: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 6. Curved Partitions:

- a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
- b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 2216

SECTION 09 2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Section 07 9219 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
2. Section 09 2216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

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

1.3 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CertainTeed Corporation.
 - 2. Continental Building Products, LLC.
 - 3. Georgia-Pacific Building Products.
 - 4. National Gypsum Company.
 - 5. USG.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
- C. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - 1. Thickness: 1/4 inch.
 - 2. Long Edges: Tapered.
- D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - 1. Thickness: 1/2 inch.
 - 2. Long Edges: Tapered.
- E. Impact-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.
 - 1. Products:
 - a. CertainTeed Corporation; Extreme Impact with M2 Technology.
 - b. Continental Building Products, LLC; Protecta HIR 300.

- c. National Gypsum Company; Hi-Impact XP Wallboard.

- d. USG Corporation; Mold Tough VHI Abuse-Resistant Panels.

2. Core: 5/8 inch, Type X.
3. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
4. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
5. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
6. Hard-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements according to test in Annex A1.
7. Long Edges: Tapered.
8. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (control) joint.
 - d. Curved-Edge Cornerbead: With notched or flexible flanges.
 - e. Base-of-Wall Galvanized Moisture Barrier Trim: Galvanized-steel sheet, 2 inches high.
 - 1) <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - f. Base-of-Wall PVC Moisture Barrier Trim: Extruded PVC, [1/2 inch] [1-3/4 inch] [3-1/2 inch] high.
 - 1) <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eagle Aluminum.
 - b. Fry Reglet Corporation.
 - c. Gordon Inc.
 - d. Pittcon Industries.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: **[Corrosion-resistant primer compatible with joint compound and finish materials specified]** <Insert requirements for Class II anodic finishes and factory-painted, baked-enamel finishes>.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.6 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
- D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 2. Thickness: 3-1/2 inches unless indicated otherwise.
- E. Acoustical Sealant: As specified in Section 07 9219 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 APPLYING PANELS

- A. General: Comply with ASTM C 840.
1. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
 2. Form control and expansion joints with space between edges of adjoining gypsum panels.

3. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - b. Fit gypsum panels around ducts, pipes, and conduits.
 - c. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
 4. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
 5. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
 6. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
 7. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
 8. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.
- B. Install interior gypsum board in the following locations:
1. Type X: Vertical surfaces unless otherwise indicated.
 2. Flexible Type: Apply in double layer at curved assemblies.
 3. Ceiling Type: Ceiling surfaces.
- C. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- D. Multilayer Application:
1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

- E. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- F. Curved Surfaces:
 - 1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
 - 2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.
- G. Installing Trim Accessories: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
 - 1. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
 - 2. Interior Trim: Install in the following locations:
 - a. Cornerbead: Use at outside corners.
 - b. Bullnose Bead: Use **at outside corners**.
 - c. LC-Bead: Use **at exposed panel edges**.
 - d. L-Bead: Use **where indicated**.
 - e. U-Bead: Use **at exposed panel edges**.
 - f. Curved-Edge Cornerbead: Use at curved openings.

3.2 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for sound or fire rated assemblies.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."
 - 4. Level 5: At panel surfaces that **[will receive] [gloss paint] [semi-gloss paint] [or] [are curved] [and other locations indicated on Drawings]**.
 - a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."

3.3 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 09 2900

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SECTION 10 4413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

- 1.1 HYPERLINK
"http://contact.arcomnet.com/ContentContact.aspx?sect=104413&ver=06/01/17&format=SF&sid=13143"
SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.

B. Related Requirements:

1. Section 10 4416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.2 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.3 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Babcock-Davis.
 2. Guardian Fire Equipment, Inc.
 3. JL Industries, Inc.; a division of the Activar Construction Products Group.
 4. Larsens Manufacturing Company.
 5. Nystrom, Inc.

6. Potter Roemer LLC.
- B. Cabinet Type: Suitable for fire extinguisher.
 1. Cabinet Construction: Fire rating matching rating of wall installed in.
 - a. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.
 2. Cabinet Material: Cold-rolled steel sheet.
 3. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - a. Rolled-Edge Trim: 2-1/2-inch backbend depth.
 4. Cabinet Trim Material: Same material and finish as door.
 5. Door Material: Steel sheet.
 6. Door Style: Vertical duo panel with frame.
 7. Door Glazing: Tempered float glass (clear).
 8. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - a. Provide projecting door pull and friction latch.
 - b. Provide concealed hinge, permitting door to open 180 degrees.
 9. Cabinet Construction: Fire rating matching rating of wall installed in.
 10. Door Glazing: Tempered float glass (clear).
 11. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - a. Provide projecting door pull and friction latch.
 - b. Provide concealed hinge, permitting door to open 180 degrees.
- C. Materials:
 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Color: White.
 2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

- C. Install fire-protection cabinets in locations and at mounting heights indicated.
 - 1. Fire-Protection Cabinets: 42 inches above finished floor to top of fire extinguisher unless indicated otherwise.
- D. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
- E. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION 10 4413

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SECTION 10 4416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

- 1.1 HYPERLINK
"http://contact.arcomnet.com/ContentContact.aspx?sect=104416&ver=06/01/17&format=SF&sid=13144"
SUMMARY
- A. Section includes portable, hand-carried fire extinguishers **and mounting brackets for fire extinguishers**.
- B. Related Requirements:
1. Section 10 4413 "Fire Protection Cabinets."
- 1.2 ACTION SUBMITTALS
- A. Product Data: For each type of product.
- 1.3 INFORMATIONAL SUBMITTALS
- A. Warranty: Sample of special warranty.
- 1.4 CLOSEOUT SUBMITTALS
- A. Operation and maintenance data.
- 1.5 COORDINATION
- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.
- 1.6 WARRANTY
- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
- a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
- b. Faulty operation of valves or release levers.
2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each **fire-protection cabinet and mounting bracket** indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ansul Incorporated; Tyco International.
 - b. Buckeye Fire Equipment Company.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Kidde Residential and Commercial Division.
 - e. Larsens Manufacturing Company.
 - f. Nystrom, Inc.
 - g. Potter Roemer LLC.
 - 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, **and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.**
- B. Multipurpose Dry-Chemical Type in Steel Container : UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard **galvanized** steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or **[red]** **[black]** baked-enamel finish.
 - 1. Manufacturer: Provide product by same manufacture as fire extinguisher.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers **and mounting brackets** in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor unless indicated otherwise.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 4416

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SECTION 13 3419 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural-steel framing.
2. Insulated metal roof panels.
3. Foamed-insulation-core metal wall panels.
4. Metal soffit panels.
5. Accessories.

B. Related Requirements:

1. Section 07 7253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface.
2. Section 08 3323 "Overhead Coiling Doors" for coiling vehicular doors in metal building systems.

1.2 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 03 3000 "Cast-in-Place Concrete."
- B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component.
- B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and attachments to other work.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: For the following products:
1. Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
 2. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.

3. Vapor-Retarder Facings: Nominal 6-inch- square Samples.
 4. Windows: Full-size, nominal 12-inch- long frame Samples showing typical profile.
 5. Accessories: Nominal 12-inch- long Samples for each type of accessory.
- E. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.
1. Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.
 2. Keying Schedule: Detail Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
- F. Delegated-Design Submittal: For metal building systems.
1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For erector.
- B. Welding certificates.
- C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
1. Name and location of Project.
 2. Order number.
 3. Name of manufacturer.
 4. Name of Contractor.
 5. Building dimensions including width, length, height, and roof slope.
 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 7. Governing building code and year of edition.
 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- D. Erector Certificates: For qualified erector, from manufacturer.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
 - 2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.9 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: **20** years from date of Substantial Completion.
- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
 - 1. Warranty Period: **20** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A & S Building Systems, Inc.; a division of NCI.
2. ACI Building Systems, Inc.
3. All American Systems; a division of NCI Building Systems Inc.
4. Alliance Steel, Inc.
5. American Buildings Company; a Nucor Company.
6. BC Steel Buildings, Inc.
7. Behlen Mfg. Co.
8. Bigbee Steel Buildings, Inc.
9. Butler Manufacturing Company; a division of BlueScope Buildings North America, Inc.
10. CBC Steel Buildings; a Nucor company.
11. Ceco Building Systems; an NCI company
12. Chief Buildings; Chief Industries, Inc.
13. Dean Steel Buildings, Inc.
14. Garco Building Systems; a division of NCI.
15. Golden Giant Inc.
16. Gulf States Manufacturers; Nucor Company.
17. Heritage Building Systems; a division of NCI Building Systems Inc.
18. Inland Buildings; a Schulte Building Systems Company.
19. Kirby Building Systems; a Nucor Company.
20. Ludwig Buildings, LLC.
21. Mesco Building Solutions; a division of NCI Building Systems Inc.
22. Metallic Building Company.
23. Mid-West Steel Building Company; an NCI company.
24. Nucor Building Systems.
25. Oakland Metal Buildings, Inc.
26. Packaged Steel Building, Inc.
27. Pinnacle Structures, Inc.
28. Red Dot Buildings.
29. Roberson Building Systems; a division of NCI Building Systems Inc.
30. Ruffin Building Systems, Inc.
31. Schulte Building Systems, LLP.
32. Spirco Manufacturing.
33. Star Building Systems; a division of NCI Building Systems Inc.
34. Steel Systems; a division of NCI Building Systems Inc.
35. Trident Building Systems, Inc.
36. Tyler Building Systems, LP.
37. United Structures of America, Inc.
38. Varco-Pruden Buildings; a division of BlueScope Buildings North America, Inc.
39. Vulcan Steel Structures, Inc.
40. Whirlwind Building Systems.

2.2 SYSTEM DESCRIPTION

- A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
- B. Primary-Frame Type:
 1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

- C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.
- D. Secondary-Frame Type: Manufacturer's standard purlins and joists and exterior-framed (bypass) girts.
- E. Roof System: Manufacturer's standard foamed-insulation-core metal roof panels. Basis of Design: Vertical rib.
- F. Exterior Wall System: Manufacturer's standard foamed-insulation-core metal wall panels. Basis of Design: Board and batten appearance.

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design metal building system.
- B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Fire-Resistance Ratings: Where assemblies are indicated to have a fire-resistance rating, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 or ASTM E 108 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory," FM Global's "Approval Guide," or from the listings of another qualified testing agency.
- E. Fire Propagation Characteristics: Exterior wall assemblies containing foam plastics pass NFPA 285 fire test.
- F. Structural Performance for Metal Roof **and** Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: As indicated on Drawings.
- G. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 **or** **ASTM E 283** at the following test-pressure difference:

1. Test-Pressure Difference: **6.24 lbf/sq. ft.**
 - H. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
 1. Test-Pressure Difference: **6.24 lbf/sq. ft.**
 - I. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 **or ASTM E 331** at the following test-pressure difference:
 1. Test-Pressure Difference: **6.24 lbf/sq. ft.**
 - J. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 1. Test-Pressure Difference: **6.24 lbf/sq. ft.**
 - K. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 1. Uplift Rating: **UL 90.**
 - L. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:
 1. Three-year, aged, solar reflectance of not less than **0.55** and emissivity of not less than **0.75**.
 2. Three-year, aged, Solar Reflectance Index of not less than **64** when calculated according to ASTM E 1980.
 - M. Thermal Performance for Opaque Elements: Provide the following maximum U-factors and minimum R-values when tested according to ASTM C 1363 or ASTM C 518:
 1. Roof:
 - a. U-Factor: 0.032.
 - b. R-Value: R-30 Minimum.
 2. Walls:
 - a. U-Factor: 0.05.
 - b. R-Value: R-20 Minimum.
- 2.4 STRUCTURAL-STEEL FRAMING
- A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
 - B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

- D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters and rake beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
 - 2. Frame Configuration: Single gable.
 - 3. Exterior Column: Uniform depth or Tapered.
 - 4. Rafter: Uniform depth or Tapered.
- E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
 - 1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
 - 2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
- F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
 - 1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch- wide flanges.
 - a. Depth: As needed to comply with system performance requirements.
 - 2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch- wide flanges.
 - a. Depth: As required to comply with system performance requirements.
 - 3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
 - 4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch- diameter, cold-formed structural tubing to stiffen primary-frame flanges.
 - 5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
 - 6. Base or Sill Angles: Manufacturer's standard base angle, minimum 3-by-2-inch, fabricated from zinc-coated (galvanized) steel sheet.
 - 7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
 - 8. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
 - 9. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

- G. Canopy Framing: Manufacturer's standard structural-framing system, designed to withstand required loads; fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide frames with attachment plates and splice members, factory drilled for field-bolted assembly.
- H. Bracing: Provide adjustable wind bracing using any method as follows:
 - 1. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
- I. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.

2.5 METAL ROOF PANELS

- A. Main Roof: Standing Seam, vertical rib insulated metal panel.
- B. Window/Door canopy roofs on south elevation: Standing-Seam, **Vertical-Rib**, Metal Roof Panels : Formed with interlocking ribs at panel edges and **flat pan** between ribs..
 - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.030-inch** nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: **Two-coat fluoropolymer.**
 - b. Color: **As selected by Architect from manufacturer's full range.**
- C. Finishes:
 - 1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.6 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels : Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
 - 1. Panel Thermal-Resistance Value (R-Value): R-20 minimum.
 - 2. Facing Material: Fabricate panel with exterior and interior facings of same material and thickness. Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.030-inch**] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Surface: Board and batten appearance.
 - b. Exterior Finish: .
 - c. Color: **As selected by Architect from manufacturer's full range.**

3. Insulation Core: Modified polyisocyanurate or polyurethane foam using a non-CFC blowing agent, foamed-in-place or board type, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
 - a. Closed-Cell Content: 90 percent when tested according to ASTM D 6226.
 - b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D 1622.
 - c. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.
 - d. Shear Strength: 26 psi when tested according to ASTM C 273/C 273M.
4. Fire-Test-Response Characteristics: Class A according to ASTM E 108.
5. Surface-Burning Characteristics: Flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E 84.

B. Finishes:

1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.7 METAL SOFFIT PANELS

- A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners **and factory-applied sealant** in side laps. Include accessories required for weathertight installation.
- B. Metal Soffit Panels:
 1. Profile and material: Architect to select from the manufacturer's standard product range.
 2. Finish: Architect to select from manufacturer's standard product range
- C. Concealed-Fastener, Metal Soffit Panels : Designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners **and factory-applied sealant** in side laps.
 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.030-inch** nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: **Fluoropolymer**.
 - b. Color: **As selected by Architect from manufacturer's full range**.

2.8 THERMAL INSULATION

- A. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I (foil facing), Class 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core. Provide units tested for interior exposure without an approved thermal barrier.

- B. Retainer Strips: For securing insulation between supports, 0.025-inch nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.

2.9 PERSONNEL DOORS AND FRAMES

- A. Swinging Personnel Doors and Frames: As specified in Section 08 1113 "Hollow Metal Doors and Frames." and 08 4113 "Aluminum Entrances and Storefronts."

2.10 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
- D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.
 - 1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 - 2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, **0.030-inch** nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
 - 1. Gutter Supports: Fabricated from same material and finish as gutters.
 - 2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- long sections, complete with formed elbows and offsets.
 - 1. Mounting Straps: Fabricated from same material and finish as gutters.

- G. Roof Curbs: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048-inch nominal uncoated steel thickness prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.
- H. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.11 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.12 SOURCE QUALITY CONTROL

- A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.
 - 1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.
- B. Product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
 - 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
 - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 - 2. Locate and space wall girts to suit openings such as doors and windows.
 - 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, ventilators, and other penetrations of roof and walls.
- H. Steel Joists: Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
 2. Space, adjust, and align joists accurately in location before permanently fastening.
 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 4. Joist Installation: Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.
 5. Joist Installation: Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.
 6. Joist Installation: Weld joist seats to supporting steel framework.
 7. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.
- I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.2 METAL PANEL INSTALLATION, GENERAL

- A. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Locate metal panel splices over structural supports with end laps in alignment.
 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- B. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
 - 1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."

3.3 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
 - 1. Install ridge **and hip** caps as metal roof panel work proceeds.
 - 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
 - 1. Install clips to supports with self-drilling or self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 - 4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
 - 5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.
 - 6. Provide metal closures at **peaks rake edges rake walls and** each side of ridgecaps.
- C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
 - 1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
 - 2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
 - 3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
 - 4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.4 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 2. Shim or otherwise plumb substrates receiving metal wall panels.
 3. When two rows of metal panels are required, lap panels 4 inches minimum.
 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
 6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 7. Install screw fasteners in predrilled holes.
 8. Install flashing and trim as metal wall panel work proceeds.
 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Insulated Metal Wall Panels: Install insulated metal wall panels on exterior side of girts. Attach panels to supports at each panel joint using concealed clip and fasteners at maximum 42 inches o.c., spaced not more than manufacturer's recommendation. Fully engage tongue and groove of adjacent insulated metal wall panels.
1. Install clips to supports with self-tapping fasteners.
 2. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels as weather seal.

3.5 METAL SOFFIT PANEL INSTALLATION

- A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.
- B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

3.6 THERMAL INSULATION INSTALLATION

- A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
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3.7 DOOR AND FRAME INSTALLATION

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
- B. Personnel Doors and Frames: Install doors and frames according to NAAMM-HMMA 840. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
 - 1. Between Doors and Frames at Jambs and Head: 1/8 inch.
 - 2. Between Edges of Pairs of Doors: 1/8 inch.
 - 3. At Door Sills with Threshold: 3/8 inch.
 - 4. At Door Sills without Threshold: 3/4 inch.
 - 5. At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.
- C. Field Glazing: Comply with installation requirements in Section 08 8000 "Glazing."
- D. Door Hardware:
 - 1. Install surface-mounted items after finishes have been completed at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 - 4. Set thresholds for exterior doors in full bed of sealant complying with requirements for concealed mastics specified in Section 07 9200 "Joint Sealants."

3.8 WINDOW INSTALLATION

- A. General: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fasten in place according to manufacturer's written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.
 - 1. Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440.
- B. Set sill members in bed of sealant or with gaskets, for weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Mount screens directly to frames with tapped screw clips.

3.9 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
 - 1. Provide elbows at base of downspouts to direct water away from building.
 - 2. Tie downspouts to underground drainage system indicated.
- E. Circular Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Mount ventilators on flat level base. Install preformed filler strips at base to seal ventilator to metal roof panels.
- F. Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal roof panels.
- G. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.

- H. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.10 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.
- B. Product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 13 3419