TowerPinkster
Architecture · Engineering · Interiors

CENTRAL ELEMENTARY SCHOOL BID PACKAGE 4 - CONSTRUCTION
New Construction

PROJECT MANUAL

5/17/2023

OWNER

PORTAGE PUBLIC SCHOOLS

8107 MUSTANG DRIVE
PORTAGE, MI 49002

PROJECT NUMBER

Architect's Project No. 21237.10
State File No.
State Index No.

SET NUMBER

VOLUME NUMBER 1

Divisions 00 Through 14

Tower Pinkster Titus Associates, Inc.
242 East Kalamazoo Avenue, Suite 100, Kalamazoo, MI 49007-5828
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Refer to Construction Manager's Project Manual issued by Owen Ames Kimball for additional procurement, contracting, and general requirements

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DOCUMENT 00 2600 - PROCUREMENT SUBSTITUTION PROCEDURES

1.1 DEFINITIONS

A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.

B. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 01 2500 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

1.2 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.

1.3 PROCUREMENT SUBSTITUTIONS

A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:

1. Extensive revisions to the Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
3. The request is fully documented and properly submitted.

1.4 SUBMITTALS

A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing in compliance with the following requirements:

1. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
2. Submittal Format: Submit each written Procurement Substitution Request, using form bound in Project Manual.
    a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.
    b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:

1) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
2) Copies of current, independent third-party test data of salient product or system characteristics.
3) Samples where applicable or when requested by Architect.
4) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. 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.
5) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
6) Research reports, where applicable, evidencing compliance with building code in effect for Project, from ICC-ES.
7) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate the proposed substitute.

c. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.

d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.

B. Architect's Action:

1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

C. Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF DOCUMENT 00 2600

SECTION 00 3100 - AVAILABLE PROJECT INFORMATION

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: Geotechnical Report.
2. Date: July 28, 2022.
3. Prepared by: Driesenga & Associates
4. Bound following this section.

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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DRIESENGA & ASSOCIATES, INC.
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www.driesenga.com
Lansing Kalamazoo Grand Rapids Ypsilanti

July 28, 2022 ***via electronic mail***

Ms. Paula Johnson
PORTAGE PUBLIC SCHOOLS
8107 Mustang Drive
Portage, Michigan 49002

Re: Geotechnical Report
Portage PS – Central Elementary
8422 South Westnedge Avenue, Portage, Michigan
Driesenga & Associates, Inc. Project No 2250349.3A

Dear Ms. Johnson:

Driesenga & Associates, Inc. is pleased to submit the attached report of subsurface exploration performed for the above-referenced project. The report presents the exploration procedures, subsurface conditions encountered, and our recommendations for development of the site with respect to proposed earthwork, foundation construction, and pavement design. As the project nears construction you can contact Andrew Anscheutz at 269-544-1455 in our local office to provide a quote for construction materials testing and survey needs.

Proper execution of our recommendations will affect the design, construction and performance of the structure and related facilities, and the potential associated risks involved. Therefore, the issues and recommendations presented in this report should be discussed with the project team, including Driesenga & Associates, Inc. This will increase the likelihood that the issues are understood and our recommendations are applied in a manner consistent with the project budget, tolerance of risk, and expectations for performance and maintenance.

We appreciate the opportunity to be of service to you. If you have any questions concerning this report, or if we can be of further service as design and construction progresses, please contact our office.

Sincerely,
DRIESENGA & ASSOCIATES, INC.

Michael Stork
Senior Project Geologist

Musana Nabil
Senior Project Engineer

Randy Pail, P.E
Director of Geotechnical Engineering

GEOTECHNICAL REPORT

SITE:

PORTAGE PS – CENTRAL ELEMENTARY
8422 SOUTH WESTNEDGE AVENUE
PORTAGE, MICHIGAN

JULY 27, 2022
PROJECT NO. 2250349.3A

PREPARED FOR:

PORTAGE PUBLIC SCHOOLS
8107 MUSTANG DRIVE
PORTAGE, MICHIGAN 49002

Prepared by:

DRIESENGA & ASSOCIATES, INC.
Engineering · Surveying · Testing

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APPENDICES

1.0 INTRODUCTION

1.1 LOCATION

This report presents the results of the geotechnical investigation completed for the new Central Elementary School located just west of the existing school building. The site is located at 8422 South Westnedge Avenue in Portage, Michigan as shown on Figure 1 – Site Location (Appendix A). The property is situated on the west side of S. Westnedge Avenue in an area of primarily residential and educational development. The existing elementary school will remain in place and occupied during construction of the new building.

1.2 PURPOSE

The purpose of this investigation was to determine the subsurface profile, the engineering characteristics of the subsurface soils, and to provide recommendations in regard to the proposed design and construction based on our interpretation of the test results. This report was prepared in general accordance with our proposal dated March 22, 2022, as authorized by Mr. Michael Galovan of TowerPinkster on May 2, 2022.

1.3 SCOPE

The field exploration to estimate engineering characteristics of the site soils included performing a site reconnaissance, advancing the soil borings, performing standard penetration tests, and recovering split-spoon samples. Soil boring locations were determined in the field by measuring from existing site features. Existing ground surface elevations were not provided and obtaining them was beyond the scope of this investigation.

Twenty-eight (28) soil borings, designated SB-1 to SB-28, were advanced in the vicinity of the proposed building and site improvement areas on July 7, 8, 11, 12 and 13, 2022, at the approximate

locations shown on Figure 2 - Boring Locations (Appendix A). The soil borings were advanced with hollow-stem augers to depths of fifteen (15) or thirty (30) feet below the ground surface. During drilling, soil samples were collected from split-spoon sampling via standard penetration testing (ASTM method D 1586) at intervals of 2.5 feet to a depth of 10 feet, and intervals of 5 feet from a depth of 10 feet to the end of each boring. The soil boring logs are contained in Appendix B. The field and laboratory procedures are described in Appendix C.

1.4 DESIGN INFORMATION

It is understood the proposed new elementary school building is to be a two-story masonry block and steel framed structure supported on poured concrete foundations and flat steel roof. The new construction will also include several new parking areas, drives and playgrounds.

Structural load information was not available as of the time of this report, but should be provided to Driesenga & Associates, Inc. for review in light of the recommendations contained herein as soon as available. For calculation purposes, maximum loads of 5,000 pounds per lineal foot of wall and 100 kips per column were assumed. Understanding that the new construction will not include any basement areas, exterior footing depths are assumed to be a minimum of 3.5 feet below the final ground surface elevation.

We have assumed maximum tolerable settlements of 1 inch total and ½ inch differential. We do not anticipate and significant cuts or fills will be required to establish site grades. Any significant deviation from these assumptions should be brought to the attention of Driesenga & Associates, Inc. as soon as possible.

2.0 SITE CONDITIONS

2.1 GENERAL

The stratification of the soils, as shown on the soil boring logs in Appendix B, represents the soil conditions at the actual soil boring locations. Variations may occur away from or between the soil borings. Stratigraphic lines shown on the soil boring logs represent the approximate boundary between the soil types, but the transition may be gradual. They are not intended to show exact depths of change from one soil type to another. In addition, changes in soil type may occur between the sample intervals that are consequently not observed by the driller.

The soil boring logs in Appendix B include the drilling method, materials encountered, penetration resistances, and pertinent field observations made during the drilling operations along with the results of the laboratory testing.

2.2 SURFACE CONDITIONS

The area of the new building is currently maintained lawn and playground areas. The new pavement area are currently a combination of maintained grass and asphalt/concrete pavement. This area is relatively flat. The existing building is surrounded by maintained lawn, asphalt parking, and driveway areas associated with residential and commercial uses.

2.3 DESCRIPTION OF SUBSURFACE SOILS

Surface materials encountered at the site generally consist of either 5 to 5.5 inches of asphalt underlain by 4 to 4.5 inches of aggregate base material or 6 to 36 inches of topsoil. Underlying the surface materials, loose to medium dense clayey sand or silty sand was encountered to a depth of around 3 to 4 feet. Loose to medium dense sand underlies the more cohesive sands and extends to

a depth of at least 30 feet. Fill soils were encountered in several of the borings and ranged in thickness from 1.5 to 5.5 feet. Buried topsoil layers were encountered in soil borings SB-9 and SB-13 at a depth of 1 foot and 2.5 feet, respectively, and ranged from 7 to 14 inches thick.

The estimated group symbol, according to the USCS, is shown in the USCS column just before the textural description of the various strata on the soil boring logs in Appendix B.

2.4 GROUNDWATER OBSERVATIONS

Groundwater was initially encountered at depths ranging from 10.0 feet to 17.5 feet below the existing ground surface. Upon completion of the borings, groundwater was measured at depths ranging from 10.1 to 17.4 feet. Hydrostatic groundwater levels and the elevations and volumes of groundwater should be expected to fluctuate throughout the year, based on variations in precipitation, evaporation, run-off, and other factors. The groundwater levels (or lack thereof) indicated by the soil borings and presented in this section represent conditions at the time the readings were taken. The actual groundwater levels at the time of construction may vary.

Groundwater measurements were collected during drilling and attempted shortly after completion of the drilling operations. After drilling and collection of groundwater readings, the boreholes were backfilled with auger cuttings and the surface was repaired approximating previous conditions. Since the boreholes were backfilled shortly after drilling, long-term groundwater level information is not available from the soil borings. To obtain long-term groundwater levels, groundwater observation wells would be required.

2.5 SEISMIC SITE CLASS

The proposed building's seismic class was determined for use in the structural design of the proposed project. Soils information was obtained from the soil borings completed on-site, as well as information obtained from the "Soil Survey of Kalamazoo County" by the United States

Department of Agriculture, the "Quaternary Geology of Michigan" completed by W.R. Farrand, the USGS Topographic Quadrangle and the Hydrogeologic Atlas of Michigan. It is assumed that the proposed structure falls under Building Class III according to the 2015 Michigan Building Code (MBC) Table 1604.5. Based on this information it is our determination that seismic site class D be used according to the ASCE 7 – Table 20.3-1 for structural calculations.

2.6 LIMITATIONS

Soil and groundwater conditions have been observed and interpreted at the soil boring locations only. This information has been used as the basis for our analyses and the recommendations that follow. Although we have allowed for minor variations in subsurface conditions in the development of our recommendations, conditions can vary away from and between soil boring locations. Should this become evident during construction, we should be contacted to review our recommendations. This geotechnical evaluation and report were prepared for geotechnical purposes only. We did not perform environmental related borings or analytical tests.

3.0 RECOMMENDATIONS

3.1 SITE PREPARATION

To increase the likelihood that the recommended allowable soil bearing capacities are achieved and tolerable settlements are not exceeded, the recommendations contained herein should be followed. Within the building footprint and any areas to receive fill, all existing building material, topsoil, old fill, organic-containing material, frozen soil and other unsuitable material should be removed. The clearing should extend a minimum of 5 feet beyond the limits of proposed building and pavement areas and areas to receive structural fill. The buried topsoil in the vicinity of soil boring SB-9 and 13 must be removed before construction. The exact horizontal and vertical extent of the buried topsoil/organics is not known and should be field verified to ensure its complete removal. We recommend a test pit evaluation be performed to better delineate the areas of buried topsoil. We recommend including a contingency in the project budget to account for the unknown amount of topsoil.

It is strongly recommended that the building pad and pavement subgrade areas be evaluated by Driesenga & Associates, Inc. after the area has been cleared and stripped. This evaluation may be performed by proofrolling with a loaded tandem axle dump truck or another method selected by the geotechnical engineer. To identify any areas of soft subgrade soil. Where soft subgrade soils are encountered, remedial actions as recommended by the geotechnical engineer will be required.

We understand portions of the existing structure(s) maybe be demolished as part of the project. Any existing foundations, floor slabs, utilities, and other below-grade structures from previous construction should be completely removed from the footprint of the proposed building. In proposed pavement areas, existing utilities and other below-grade structures should be removed to at least 2.5 feet below the final subgrade level. Alternatively, utilities can be left in place below pavement areas if the void space of the utility is completely grouted. Depressions or excavations from the demolition and removal operations should be backfilled with granular structural fill

meeting the requirements of MDOT Class II sand compacted in accordance with the recommendations below.

Existing fill was encountered in several of the soil borings and extended about 1.5 to 5.5 feet below the existing ground surface. Without documentation of the placement of the fill, we consider it to be "uncontrolled fill." If documentation of the existing fill is available, we would be pleased to review it to determine its suitability of slab, pavement, and/or structural fill support.

Deeper and/or looser uncontrolled fill may be encountered at the site, particularly adjacent to existing or former structures, or in the vicinity of existing utilities. The existing fill ***may*** be suitable for support of slabs, pavements, and/or structural fill after additional evaluation and special preparation ***and only where it is not underlain by buried topsoil or other organic, deleterious or otherwise unsuitable soils*** and the owner accepts the risks in doing so. Some of the soil samples in the existing fill contained variable amounts of organic material/topsoil. Existing fill with excessive organics (over 4%), voids or debris should be removed and replaced with structural fill. Test pits should be performed to identify unsuitable fill. The test pits could be performed prior to construction. However, suitability of the existing fill will need to be determined on a case-by-case basis during construction. The remaining fill, after removing unsuitable fill, is anticipated to be suitable to support floor slabs, pavements and structural fill, provided an increased risk of unsatisfactory performance is acceptable. We believe the risk of unsatisfactory performance such as cracking and settlement associated with the construction of slabs-on-grade and pavements on or above the existing fill is relatively low after preparation.

Ultimately, if the risk of poor slab and/or pavement performance is not acceptable, complete removal of the existing fill and replacement with structural fill should be performed. Based on the soil borings, the existing fill could extend 5.5 feet or more below the existing ground surface. If performed, the removal of the existing fill should extend a minimum of 10 feet beyond the edges of the proposed building, or laterally on a two vertical to one horizontal slope from the bottom outside edge of the foundation, whichever is greater. This action should reduce the amount and depth of

undercutting during foundation construction since the unsuitable fill and any unsuitable soils directly beneath fill would be removed. For this case, the test pit evaluation would not be necessary. However, a test pit evaluation could be performed to provide a better estimate of the nature, depth and extent of the existing fill.

In all general fill areas, the exposed soil surface should be scarified to a depth of 12 inches and recompacted to a minimum of 95% of Modified Proctor maximum dry density (MDD) per ASTM D 1557 method, or 98% of MDD as determined by the Michigan Cone Method. Sand soils were encountered at or near the final subgrade level in some of the soil borings in the proposed building area. Within the proposed building area the native sand should be proof-compacted by at least six (6) passes of a 10-ton vibratory roller.

The contractor should remove standing water from the subgrade and prevent surface water from reaching the footing excavations and the prepared subgrade. In addition, construction traffic should use haul roads and should not haphazardly traffic the site. Subgrade soils that become disturbed should be removed and replaced with structural fill or crushed aggregate. Under wet weather conditions, the subgrade may be protected by placing crushed aggregate on the exposed subgrade.

It is recommended that any fill materials be placed in or near horizontal maximum 8-inch-thick loose lifts and compacted to a minimum of 95% of Modified Proctor MDD, or 98% of Michigan Cone MDD. If a vibratory roller is used for compaction, the loose lift thickness may be increased to 12 inches. Soils used for structural fill should consist of clean sand meeting SW or SP classification in accordance with USCS criteria.

3.2 FOUNDATIONS

Considering the subsurface conditions on this site and the assumed proposed construction, it is acceptable for the proposed facility to be supported on conventional spread footings. Footings

bearing on newly placed structural fill placed over suitable native soils or directly on the native sand may be designed for a maximum net allowable soil bearing pressure of 2,500 psf. The footings should not be placed on the existing fill material.

At some locations, the native sand soils may be in relatively loose condition and not suitable for support of foundations at the recommended design soil bearing pressure. In addition, these soils may become loosened below the bottom of footing level from the excavation activities or from construction traffic, especially if allowed to dry out. Therefore, the excavated footing bearing surfaces should be compacted to a minimum of 95% of Modified Proctor MDD, or 98% of MDD as determined by the Michigan Cone Method, just prior to concrete placement. A hand-operated plate compactor may be used for loose or disturbed soil that is less than 6 inches in thickness. For deeper compaction, we recommend using a hoe-pac mounted on a backhoe. Water may need to be added to achieve the desired compaction for the allowable bearing capacity.

If it is not possible to improve the sands by densification, the unsuitable soils may need to be removed and the foundations placed on suitable native soils encountered at lower levels. Alternatively, the undercut may be backfilled with crushed aggregate to the bottom of footing level. In addition, wet or easily disturbed foundation bearing soils could be encountered at some locations. If wet soils are encountered, we recommend a layer of crushed aggregate be placed on the subgrade. The thickness of this layer will depend on the conditions encountered at the time of construction. In areas where undercutting is required, the undercut should extend laterally on a two vertical to one horizontal slope from the edge of the footing.

All perimeter footings and footings in unheated areas should bear at least 42 inches below finished grade for protection from frost action. To reduce the likelihood of frost heave, trench footings should be formed vertically and should not be allowed to widen near the top. If interior footings are to bear on compacted fill, the fill should be placed in accordance with the recommendations of Section 3.1. Interior foundations can be constructed on suitable natural soils or on structural fill overlying suitable natural subgrade just below the floor slab. However, the footings and proposed

bearing soils should be protected from freezing during construction if work is conducted in the cold winter months. Due to the sands encountered at the site, construction of trench footings is probably not feasible. Therefore, we anticipate footing excavations will need to be sloped back and the foundations formed. The placement of footing concrete should be done as soon as footing excavations have been completed and approved to reduce the potential for disturbance or freezing of the footing subgrade.

Prior to concrete placement, the bearing surface should be free of loose soil and standing water. The contractor should avoid stockpiling excavated materials immediately adjacent to the excavation walls. It is recommended that stockpiled materials be kept back from the excavation a minimum distance equal to half the excavation depth to prevent surcharging the excavation walls.

Total and differential settlement of foundations properly designed and constructed based on our recommendations are not expected to exceed 1 inch and ½ inch, respectively.

3.3 FLOORS

The soil below the floor slab should be prepared in accordance with the recommendations in Section 3.1. A noncohesive soils mat such as MDOT Class II sand should be provided directly below the floor slabs. The mat should be a minimum of 8 inches in thickness and compacted to a minimum of 95% of Modified Proctor MDD.

The floor slab should be suitably reinforced and proper joints should be provided at the junctions of the slab and foundation system so that a small amount of independent movement can occur without causing damage. A minimum of 6 inches of structural fill should be provided between the bottom of the slab and the top of the shallow spread footing below. Otherwise, other arrangements should be made to allow for potential relative settlements, such as grade beams, thickened slabs with appropriate reinforcing steel or other appropriate details. A modulus of subgrade reaction of 175 pci should be used in the design of slabs-on-grade.

3.4 PAVEMENTS

Specific traffic information was not available in developing these pavement recommendations. For design purposes, we have assumed that passenger vehicles and light trucks will traffic all standard duty pavement areas. Heavy duty pavement areas will include entrances, service drives and bus parking areas, and will be trafficked by buses, refuse trucks, and fire engines.

The pavement subgrade should be prepared as described in Section 3.1. Above the subgrade, the sand subbase should be constructed using a minimum of 12 inches of Michigan Department of Transportation (MDOT) Class II Fine Aggregate fill (MDOT Division 3, Section 301 "2012 Standard Specifications for Construction", April 1, 2011) compacted to a minimum of 95% of the material's MDD as determined by Modified Proctor.

Due to the clayey sand soils encountered at some areas of the site, site grading and stormwater controls will be important to protect paved drives and parking areas. To further protect new paved areas, perimeter underdrains should be placed beneath pavement edges within the bottom portion of the pavement sand subbase. Four (4) inch-diameter sock-tube backfilled with at least 6 inches of peastone cover should be used. The drains should flow via gravity to a common low point and into the off-site storm sewer system.

The aggregate base for pavement areas should follow MDOT Dense-Graded Aggregate Base Course Materials – Division 3, Section 302 and Division 9, Section 902, using a 21AA (Grading Requirements per MDOT Table 902-1) Limestone Dense-Graded Aggregate material with a minimum compacted thickness of 8 inches. This gravel base may be placed in one (1) lift and should be compacted to a minimum of 95% of the material's MDD as determined by Modified Proctor.

Light/medium duty bituminous pavement should consist of a 1.5 inch base course and a 1.5 inch surface course for a total thickness of 3.0 inches. Heavy duty bituminous pavement should consist of a 2.5 inch base course and a 1.5 inch surface course for a total thickness of 4.0 inches. The HMA material and binder should be selected in accordance with the Local Agency Programs Hot Mix Asphalt Selection Guidelines Revised November 1, 2017 and FHWA Approved December 26, 2017. Compaction of asphalt courses should range between 92% and 96% of the Theoretical Maximum Density (TMD).

Construction traffic should be minimized on the new pavement. If excessive construction traffic is anticipated on the pavement structure, the initial asphalt lift thickness could be increased and placement of the final lift could be delayed until the majority of the construction activities have been completed. This action will allow repair of localized failure, if any does occur, as well as reduce load damage on the pavement system.

A bond coat of emulsion should be used between the base course and wearing course when more than 48 hours have elapsed between placement of the courses, or the surface of the base course has been contaminated by soil or dust. Performance grade asphalt cement should be used in the production of all bituminous mixtures. Reclaimed Asphalt Pavement (RAP) should not be used in the surface course.

After the pavement is complete, we recommend instituting a regular maintenance program that includes sealing of cracks and patching of distressed areas. This should reduce the effect of water infiltration and associated frost action.

In areas where the durability of Portland cement concrete (PCC) is desired over bituminous pavement (i.e., loading areas, dumpster pads) a rigid pavement is recommended. Concrete pavement should be constructed on a base layer of at least 6 inches of Michigan Department of Transportation (MDOT) Class II sand subbase (Division 9, Section 902, Grading Requirements per Table 902-3). The concrete slab should consist of a minimum of 6 inches of 4,000 psi, air entrained

concrete (MDOT Division 6, Section 601 – PCC Pavement and Division 9, Section 901 – Cement and Lime); however, actual design of the slab including reinforcement type and spacing should be performed by the Project Structural Engineer.

These recommendations assume typical conditions during the June through September construction season. Any substitution of materials or deviation from these stated assumptions should be reviewed to assess potential impact on the recommended design.

3.5 GROUNDWATER CONTROL

Groundwater was encountered at 10.0 feet to 17.5 feet below existing ground surface elevation. As such, groundwater problems are not expected to be a significant issue with respect to building construction. Any water which enters the footing excavation can likely be controlled by a gravity drain system, sump pump, or other minor dewatering procedure. Concrete should not be poured in footing excavations containing water. Upon removal of any trapped water, the soils should be reviewed by a geotechnical engineer and any soft areas replaced with structural fill per Section 3.1, as necessary.

As stated in Section 3.4, perimeter underdrains should be placed beneath all pavement edges within the lower portion of the 12 inches sand subbase. Four (4) inch-diameter sock-tube backfilled with at least 6 inches of peastone cover should be used. The drains should flow via gravity to a common low point and into the on-site storm sewer system. In addition, finger drains should extend radially out from the catch basins and gutter inlets.

Perimeter foundation drains should be installed along foundations where interior finished floor elevations are lower than perimeter grades, or where exterior grades slope toward the building. In addition, all roof drains should be diverted to downspouts which carry water away from foundations and supporting walls.

3.6 TEMPORARY EXCAVATION STABILITY

If excavations are anticipated for the proposed structure and/or utilities, shoring and bracing or flattening (laying back) of the slopes may be required to obtain a safe working environment. Excavations should be sloped or shored in accordance with local, state and federal regulations, including OSHA (CFR Part 1926) excavation trench safety standards. We recommend that all excavated soils be placed away from the edges of the excavation at a distance equaling or exceeding the depth of the excavation. In addition, surface runoff water should be diverted away from the crest of the excavated slopes to prevent erosion and sloughing.

Localized areas of soft or unsuitable soils not detected by our borings or in unexplored areas may be encountered once construction begins. Vertical cuts in these soils may be unstable and may present a significant hazard because they can fail without warning. Therefore, temporary construction slopes greater than 5 feet high should not be steeper than one horizontal to one vertical (1H: 1V) and excavated material should not be placed within 10 feet of the crest of any excavated slope.

Unbraced excavations may experience some minor localized instability (i.e., sloughing). To reduce potential sloughing, excavated slopes should be covered with plastic for protection from rainfall and moisture changes. It should be emphasized that continuous observations by personnel from our office are important during trenching or excavation operations at the site.

4.0 GENERAL COMMENTS

If significant changes are made in the plans and specifications or location of the proposed structure(s), a consultation should be arranged to review such changes with respect to the prevailing soil conditions. It may then be necessary to submit supplementary recommendations. If deviations from the noted subsurface conditions are encountered during construction, they should also be brought to the attention of Driesenga & Associates, Inc.

Driesenga & Associates, Inc. should be afforded the opportunity to review the project design drawings and specifications to verify the factors affecting subgrade and foundation performance comply with our recommendations.

It is recommended that the services of Driesenga & Associates, Inc. be engaged to observe excavation for the footings and to test and evaluate the soils in the footing excavations prior to placement of foundations in order to determine that the soils have the required bearing capacities. Monitoring and testing should also be performed to verify that suitable materials are used for controlled fills and that they are properly placed and compacted.

This report and any future reports or addenda performed for this site should be supplied to potential bidders prior to them submitting their proposals. We also recommend the construction contract include provisions for dealing with differing conditions. Contingency funds should be reserved for potential problems during earthwork and foundation construction.

This report was for geotechnical purposes only. We did not sample for environmental purposes or perform any analytical testing. However, the contractor should be prepared to handle environmental conditions encountered at this site that may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this property should be made available for review by bidders and the successful contractor.

This report has been prepared solely for the use of the client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in this project, unless written permission is granted by Driesenga & Associates, Inc. If this report or any of its contents are utilized by parties other than our original client and the project team members, Driesenga & Associates, Inc. can not be held responsible for the suitability of the field exploration, scope of services, or recommendations made for the new project. Driesenga & Associates, Inc. also is not responsible for the interpretation of our soil boring logs and the recommendations provided herein by other parties.

Driesenga & Associates, Inc. will evaluate this report for other parties and developments at this site, provided our original Client agrees to release this information in writing. However, before this report can be relied upon by other parties. Driesenga & Associates, Inc. must review the proposed development since the new project will likely require additional field exploration, laboratory tests, analysis, and modifications to our recommendations to adequately address the needs of the new project.

APPENDIX A

·FIGURE NUMBER 1 – SITE LOCATION·

·FIGURE NUMBER 2 – BORING LOCATIONS·

Scale: NTS

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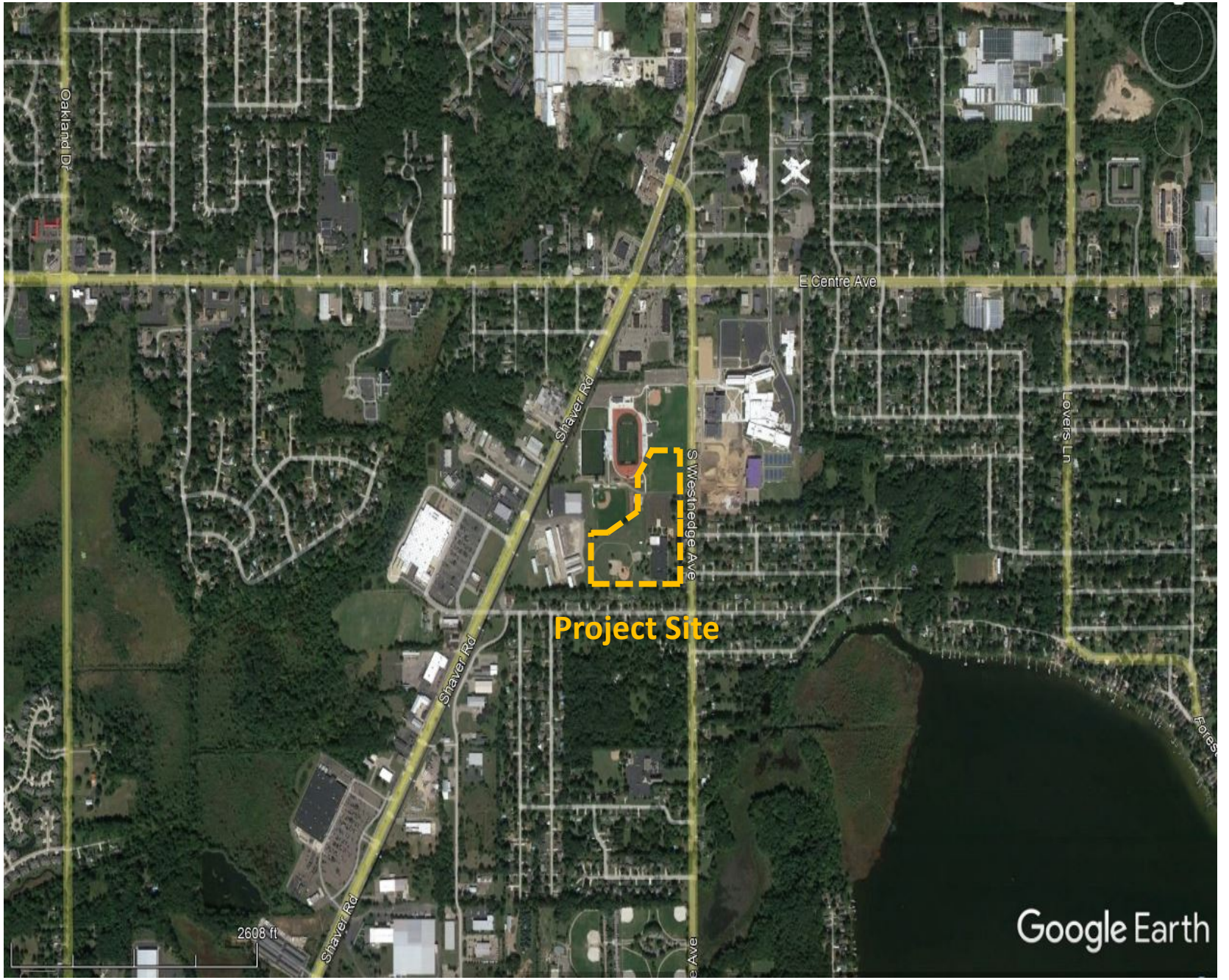
Figure Number: 1
Site Location

Project Name
Central Elementary
PPS

Project Number
2250349.3A

Project Location
8422 South
Westnedge Avenue
Portage, Michigan



Scale: NTS

Boring Location

DRIESENGA & ASSOCIATES, INC.

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Figure Number: 2

Boring Locations

Project Name

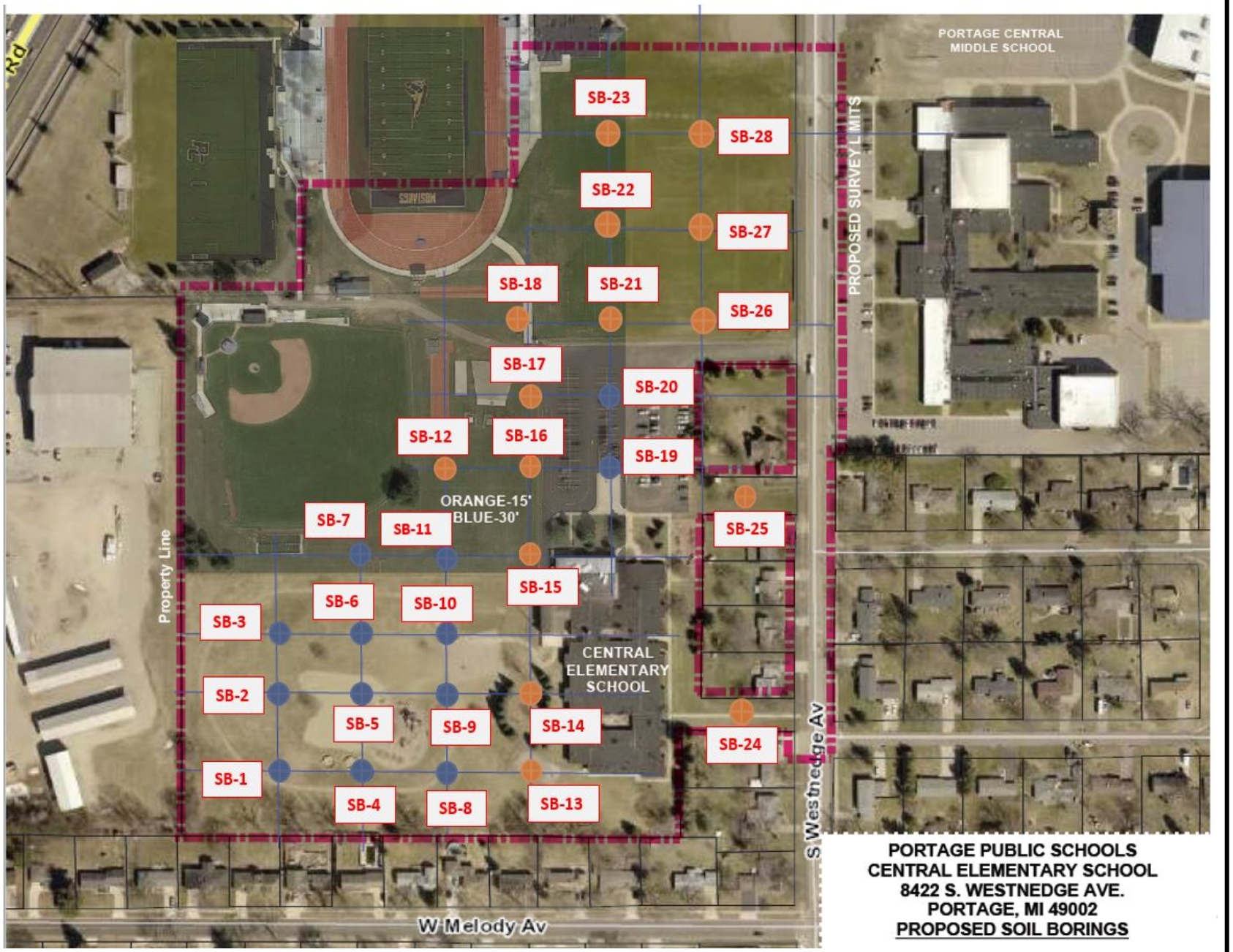
Central Elementary
PPS

Project Number

2250349.3A

Project Location

8422 South
Westnedge Avenue
Portage, Michigan



APPENDIX B

·SOIL BORING LOGS·

DRIESENGA & ASSOCIATES, INC.
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SB-1

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 7, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 7, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 17.2'
Sampling Method	: Split-Spoon Sampler	GW Completion	: 17.4'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 16 inches						
		SP		SAND, loose, brown, fine grained, trace gravel, moist.	1	1 2 4	6			
		SC		Clayey SAND, loose, brown, fine to coarse grained, a little gravel, moist.	2	3 4 4	8			
5					3	3 4 5	9			
		SW		SAND, loose to medium dense, light brown, fine to medium grained, trace silt, moist.	4	7 9 10	19			
10										
					5	5 5 7	12			
15									▽	
		SW		SAND, loose to medium dense, brown, fine to coarse grained, a little gravel, moist to wet.	6	2 4 6	10			
20										
					7	3 5 5	10			
25										
					8	4 7 8	15			
30										

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SB-2

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 7, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 7, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 14.5'
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry cave in at 14.3'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 10 inches						
		SC		Clayey SAND, loose to medium dense, brown, fine to medium grained, a little gravel, moist.	1	6 5 6	11			
					2	5 6 4	10			
5		SW		SAND, loose to medium dense, light brown, fine to medium grained, moist.	3	5 6 7	13			
					4	5 5 6	11			
10										
				SAND, medium dense, brown, fine to coarse grained, trace gravel, moist to wet.	5	5 6 9	15		▼	
15										
					6	4 5 7	12			
20		SW								
					7	4 6 8	14			
25										
					8	5 7 11	18			
30										

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DRIESENGA & ASSOCIATES, INC.
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SB-3

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 7, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 7, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 13.5'
Sampling Method	: Split-Spoon Sampler	GW Completion	: 13.3'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 21 inches						
		SM		Silty SAND, loose, brown, fine grained, trace gravel, moist.	1	2 2 4	6			
		SC		Clayey SAND, loose, brown, fine to medium grained, a little gravel, moist.	2	4 4 5	9			
5		SW		SAND, loose, light brown, fine to medium grained, moist.	3	3 4 6	10			
					4	3 4 6	10			
10		SW		SAND, medium dense, brown, fine to coarse grained, some gravel, moist to wet.	5	4 6 5	11		▽	
15		SP		SAND, medium dense, brown, fine grained, wet.	6	2 4 8	12			
20					7	5 11 14	25			
25		SW		SAND, medium dense, brown, fine to coarse grained, a little gravel, wet.	8	6 9 9	18			
30										

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DRIESENGA & ASSOCIATES, INC.
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SB-4

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 7, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 7, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 17.5'
Sampling Method	: Split-Spoon Sampler	GW Completion	: 16.3'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 14 inches						
		SM		Silty SAND, loose, brown, fine grained, trace clay, trace gravel, moist.	1	1 2 5	7			
					2	3 2 3	5			
5				SAND, loose to medium dense, light brown, fine to coarse grained, trace gravel, moist to wet.	3	7 10 13	23			
					4	2 4 6	10			
10										
					5	2 2 2	4		▽	
15		SW							▼	
					6	8 9 8	17			
20										
					7	4 7 10	17			
25										
					8	5 6 10	16			
30										

DRIESENGA & ASSOCIATES, INC.

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SB-5

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 8, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 8, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 17.2'
Sampling Method	: Split-Spoon Sampler	GW Completion	: 17.2'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 9 inches						
		SC		Clayey SAND, medium dense, brown, fine to coarse grained, some gravel, moist.	1	8 8 6	14			
		SW		SAND, medium dense, brown, fine to medium grained, trace silt, moist.	2	2 2 8	10			
5				SAND, loose to medium dense, light brown, fine to coarse grained, trace gravel, moist to wet.	3	8 10 9	19			
					4	4 6 7	13			
10										
					5	4 5 5	10			
15		SW							▼	
					6	2 6 5	11			
20										
					7	2 4 5	9			
25										
					8	4 7 7	14			
30										

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SB-6

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 8, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 8, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 14.2'
Sampling Method	: Split-Spoon Sampler	GW Completion	: 14.2'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 12 inches						
		SC		Clayey SAND, loose, brown, fine to coarse grained, a little gravel, moist.	1	2 4 6	10			
		SP		SAND, loose to medium dense, brown, fine grained, moist.	2	4 5 8	13			
5					3	3 3 5	8			
		SW		SAND, medium dense, light brown, fine to coarse grained, trace gravel, moist to wet.	4	5 5 7	12			
10					5	1 2 3	5		▼	
15										
					6	4 5 9	14			
20										
					7	5 7 7	14			
25										
					8	5 9 8	17			
30										

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SB-7

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 11, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 11, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 14.3'
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry cave in at 13.0'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 36 inches	1	2 3 2	5			
5		SM		Silty SAND, loose, brown, fine to medium grained, trace clay, moist.	2	3 2 5	7			
					3	3 3 4	7			
		SP		SAND, loose to medium dense, brown, fine grained, moist.	4	3 5 7	12			
10										
		SW		SAND, loose, brown, fine to coarse grained, a little gravel, moist to wet.	5	2 3 6	9		▼	
15										
		SW		SAND, loose to medium dense, brown, fine to medium grained, wet.	6	6 10 13	23			
20										
					7	2 2 3	5			
25										
					8	2 4 8	12			
30										

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SB-8

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 7, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 7, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 15.0'
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry cave in at 14.6'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 14 inches						
		SM		Silty SAND, loose, brown, fine to medium grained, trace clay, moist.	1	1 2 3	5			
5					2	3 4 5	9			
		SW		SAND, loose to medium dense, light brown, fine to coarse grained, trace gravel, moist to wet.	3	3 4 4	8			
10					4	5 5 7	12			
15					5	8 6 7	13		▼	
20					6	1 2 5	7			
		SW		SAND, medium dense, brown, fine to coarse grained, a little gravel, wet.	7	4 8 12	20			
25					8	5 7 10	17			
30										

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SB-9

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 8, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 8, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 12.2'
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry cave in at 11.7'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 4 inches						
		SC/Fill		Fill - Clayey SAND, brown, fine to coarse grained, some gravel, moist.	1	3 4 3	7			
				Buried TOPSOIL - 7 inches						
				SAND, loose to medium dense, brown, fine grained, moist.	2	2 3 4	7			
5		SP			3	6 6 7	13			
					4	6 8 12	20			
10		SW-GW		SAND & GRAVEL, medium dense, brown, fine to coarse grained, moist.					▼	
				SAND, loose to medium dense, brown, fine to coarse grained, trace gravel, moist to wet.	5	1 2 3	5			
15										
					6	3 6 8	14			
20		SW								
					7	5 9 10	19			
25										
					8	7 11 10	21			
30										

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SB-10

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 8, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 8, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 11.8'
Sampling Method	: Split-Spoon Sampler	GW Completion	: 11.8'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 22 inches	1	2 3 4	7			
		SC		Clayey SAND, loose, brown, fine to medium grained, moist.	2	3 3 4	7			
5		SW		SAND, loose to medium dense, brown, fine to medium grained, trace gravel, moist to wet.	3	4 4 3	7			
					4	5 5 5	10		▼	
10										
					5	1 3 4	7			
15										
					6	4 5 7	12			
20										
		SW		SAND, medium dense, brown, fine to coarse grained, a little gravel, wet.	7	5 7 8	15			
25										
					8	5 8 8	16			
30										

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SB-11

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 11, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 11, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 11.8'
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry cave in at 11.1'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 15 inches						
		SM		Silty SAND, very loose to medium dense, brown, fine to medium grained, trace clay, moist.	1	1 1 2	3			
					2	7 9 10	19			
5		SW		SAND, loose to medium dense, brown, fine to medium grained, trace coarse sand, trace gravel, moist to wet.	3	2 2 3	5			
					4	3 3 4	7			
10									▼	
					5	1 2 2	4			
15										
					6	3 4 7	11			
20										
					7	4 7 8	15			
25										
					8	5 8 8	16			
30										

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SB-12

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 11, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 11, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 11.1'
Sampling Method	: Split-Spoon Sampler	GW Completion	: 10.9'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 17 inches						
		SP/Fill		Fill - SAND, medium dense, brown to dark brown, fine grained, trace gravel, trace topsoil, moist.	1	7 8 9	17			
5		SP		SAND, loose, brown, fine grained, trace gravel, moist.	2	3 3 3	6			
					3	3 4 3	7			
10		SW		SAND, medium dense, light brown, fine to medium grained, trace gravel, moist to wet.	4	5 5 6	11		▽	
15		SW		SAND, loose, brown, fine to coarse grained, some gravel, wet.	5	2 3 5	8			
20										
25										
30										

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SB-13

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 11, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 11, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: Dry
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				ASPHALT - 2.5 inches						
		SC/Fill		Fill - Clayey SAND, medium dense, brown to dark brown, fine to coarse grained, a little gravel, trace topsoil, moist.	1	4 5 6	11			
				Buried TOPSOIL - 14 inches						
5		SW		SAND, loose, brown, fine to medium grained, moist.	2	7 6 4	10			
		SC		Clayey SAND, very loose, brown, fine to medium grained, trace gravel, moist.	3	2 2 2	4			
		SW		SAND, loose to medium dense, brown, fine to medium grained, trace gravel, moist.	4	4 4 5	9			
15					5	4 5 7	12			
20										
25										
30										

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SB-14

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 11, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 11, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: Dry
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 6 inches						
		SW/Fill		Fill - SAND, loose, brown to dark brown, fine to medium grained, trace gravel, trace topsoil, moist.	1	3 2 3	5			
					2	3 4 5	9			
5		SC		Clayey SAND, loose, brown, fine to medium grained, a little gravel, moist.	3	6 4 4	8			
		SP		SAND, loose, brown, fine grained, trace silt, moist.						
		SW		SAND, loose to medium dense, light brown, fine to medium grained, trace gravel, moist.	4	4 5 5	10			
10					5	6 6 8	14			
15										
20										
25										
30										

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DRIESENGA & ASSOCIATES, INC.
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SB-15

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 11, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 11, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 10.0'
Sampling Method	: Split-Spoon Sampler	GW Completion	: 10.1'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 12 inches						
		SC		Clayey SAND, medium dense, brown, fine to coarse grained, a little gravel, moist.	1	8 6 6	12			
		SW		SAND, loose, brown, fine to medium grained, trace gravel, moist.	2	3 4 4	8			
5		SP		SAND, medium dense, brown, fine grained, moist.	3	6 10 5	15			
		SW		SAND, loose to medium dense, brown, fine to medium grained, trace gravel, moist to wet.	4	5 5 5	10		▼	
10					5	3 6 10	16			
15										
20										
25										
30										

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DRIESENGA & ASSOCIATES, INC.
Engineering · Surveying · Testing

SB-16

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 11, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 11, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: 10.5'
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry cave in at 10.1'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 19 inches						
		SM/Fill		Fill - Silty SAND, medium dense, dark brown, fine to medium grained, trace clay, trace gravel, trace topsoil, moist.	1	5 9 10	19			
5		SW		SAND, loose to medium dense, brown, fine to medium grained, trace gravel, trace coarse sand, moist to wet.	2	6 6 5	11			
					3	5 4 5	9			
10					4	4 6 7	13		▼	
15					5	3 6 7	13			
20										
25										
30										

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SB-17

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 13, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 13, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Solid-Stem Auger	GW Encountered	: 13.5'
Sampling Method	: Split-Spoon Sampler	GW Completion	: 11.5'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 30 inches	1	10 7 7	14			
		SW/Fill		Fill - SAND, medium dense, brown to dark brown, fine to coarse grained, trace gravel, moist.	2	9 9 6	15			
5		SW		SAND, medium dense, brown, fine to medium grained, moist.	3	5 7 8	15			
					4	6 9 6	15		▽	
10		SW		SAND, medium dense, brown, fine to coarse grained, moist to wet.	5	5 5 8	13		▼	
15										
20										
25										
30										

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SB-18

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 13, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 13, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Solid-Stem Auger	GW Encountered	: 13.5'
Sampling Method	: Split-Spoon Sampler	GW Completion	: 12.2'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 15 inches						
		SW/Fill		Fill - SAND, medium dense, brown to dark brown, fine to medium grained, trace topsoil, moist.	1	6 9 6	15			
		SW		SAND, medium dense, brown, fine to medium grained, trace gravel lenses, moist to wet.	2	8 6 5	11			
5					3	5 7 5	12			
					4	4 6 6	12		▽	
10									▼	
					5	5 5 8	13			
15										
20										
25										
30										

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SB-19

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 12, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 12, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Solid-Stem Auger	GW Encountered	: 18.5'
Sampling Method	: Split-Spoon Sampler	GW Completion	: 15.4'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				ASPHALT - 5.5 inches						
		GW		GRAVEL - 4.5 inches						
		SC		Clayey SAND, medium dense, brown, fine to medium grained, a little gravel, moist.	1	9 10 8	18			
5		SW		SAND, medium dense, brown, fine to medium grained, trace silt, trace gravel, moist.	2	5 7 7	14			
		SW		SAND, loose to medium dense, light brown, fine to medium grained, moist.	3	8 9 8	17			
10		SW			4	4 5 7	12			
		SW		SAND, loose to medium dense, brown, fine to coarse grained, some gravel, moist to wet.	5	4 5 5	10		▽	
15		SW			6	5 6 5	11		▼	
20		SW			7	5 5 9	14			
25		SW			8	7 9 8	17			
30										

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SB-20

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 12, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 12, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Solid-Stem Auger	GW Encountered	: 18.5'
Sampling Method	: Split-Spoon Sampler	GW Completion	: 15.6'

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0		GW		ASPHALT - 5 inches						
				GRAVEL - 4 inches						
		SW		SAND, medium dense, brown, fine to medium grained, a little clay, trace gravel, moist.	1	8 7 7	14			
					2	6 6 5	11			
5										
		SW		SAND, medium dense, light brown, fine to medium grained, trace silt, moist.	3	5 7 5	12			
					4	7 6 6	12			
10										
					5	3 3 4	7		▽	
15		SW		SAND, loose to medium dense, brown, fine to coarse grained, trace gravel, moist to wet.						
					6	4 5 4	9		▼	
20										
					7	5 5 7	12			
25										
					8	6 8 9	17			
30										

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SB-21

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 12, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 12, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Solid-Stem Auger	GW Encountered	: Dry
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 8 inches						
		SW		SAND, loose to medium dense, brown, fine to medium grained, trace silt, moist.	1	4 4 5	9			
					2	4 5 6	11			
5				SAND, medium dense, light brown, fine to medium grained, moist.	3	5 6 7	13			
		SW			4	7 6 5	11			
15					5	5 5 6	11			
20										
25										
30										

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SB-22

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 13, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 13, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Solid-Stem Auger	GW Encountered	: Dry
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 14 inches						
		SW/Fill		Fill - SAND, medium dense, brown to dark brown, fine to medium grained, trace topsoil, moist.	1	5 9 5	14			
5		SW/Fill		Fill - SAND, medium dense, brown to dark brown, fine to coarse grained, trace gravel, trace clay, moist.	2	7 8 10	18			
		SW		SAND, medium dense, light brown, fine to medium grained, moist.	3	6 6 7	13			
10					4	5 5 7	12			
15					5	6 7 8	15			
20										
25										
30										

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SB-23

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 13, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 13, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Solid-Stem Auger	GW Encountered	: Dry
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 12 inches						
		SW/Fill		Fill - SAND, medium dense, brown to dark brown, fine to medium grained, a little topsoil, moist.	1	7 6 8	14			
		SC/Fill		Fill - Clayey SAND, loose, brown to dark brown, fine to coarse grained, trace gravel, moist.	2	6 5 5	10			
5		SW		SAND, medium dense, light brown, fine to medium grained, moist.	3	7 8 9	17			
					4	8 6 5	11			
10										
					5	5 7 8	15			
15										
20										
25										
30										

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SB-24

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 11, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 11, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Hollow-Stem Auger	GW Encountered	: Dry
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 22 inches	1	3 4 5	9			
		SM		Silty SAND, loose, brown, fine grained, moist.	2	3 3 4	7			
		SC		Clayey SAND, loose, brown, fine to coarse grained, a little gravel, moist.	3	5 5 6	11			
5		SW		SAND, loose to medium dense, brown, fine to coarse grained, trace gravel, moist.	4	6 7 5	12			
10					5	8 9 11	20			
15										
20										
25										
30										

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SB-25

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 12, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 12, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Solid-Stem Auger	GW Encountered	: Dry
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 11 inches						
		SC		Clayey SAND, loose, brown, fine to medium grained, moist.	1	4 5 4	9			
5		SW		SAND, loose to medium dense, brown, fine to coarse grained, trace gravel, moist.	2	3 4 3	7			
					3	3 5 6	11			
10					4	4 2 3	5			
15					5	7 4 6	10			
20										
25										
30										

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SB-26

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 12, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 12, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Solid-Stem Auger	GW Encountered	: Dry
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 10 inches						
		SC		Clayey SAND, medium dense, brown, fine to coarse grained, trace gravel, trace cobble, moist.	1	5 9 10	19			
					2	7 8 7	15			
5		SW		SAND, medium dense, brown, fine to coarse grained, trace gravel, moist.	3	9 6 7	13			
					4	7 8 8	16			
10		SW		SAND, medium dense, light brown, fine to medium grained, moist.						
					5	6 5 7	12			
15										
20										
25										
30										

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SB-27

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 12, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 12, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Solid-Stem Auger	GW Encountered	: Dry
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 12 inches						
		SM/Fill		Fill - Silty SAND, loose, brown to dark brown, fine to medium grained, trace topsoil, moist.	1	7 4 6	10			
		SW		SAND, loose to medium dense, brown, fine to coarse grained, trace gravel, moist.	2	4 4 5	9			
5					3	5 6 4	10			
					4	6 5 4	9			
10										
					5	4 4 7	11			
15										
20										
25										
30										

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SB-28

Project Name: Portage PS - Central Elementary
8422 South Westnedge Avenue
Portage, Michigan

Project No. 2250349.3A

Client Name: Portage Public Schools

Date Started	: July 12, 2022	Drilling Company	: Great Lakes Drilling
Date Completed	: July 12, 2022	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: M. Stork
Drilling Method	: Solid-Stem Auger	GW Encountered	: Dry
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry

Water Levels
▼ During Drilling
▽ After Completion

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 10 inches						
		SC/Fill		Fill - Clayey SAND, medium dense, brown to dark brown, fine to coarse grained, a little gravel, trace topsoil, moist.	1	5 8 7	15			
5		SW		SAND, loose, brown, fine to medium grained, moist.	2	5 4 4	8			
					3	3 3 4	7			
10		SW		SAND, medium dense, light brown, fine to coarse grained, a little gravel, moist.	4	5 5 6	11			
					5	7 6 7	13			
15										
20										
25										
30										

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APPENDIX C

·FIELD AND LABORATORY PROCEDURES·

FIELD PROCEDURES

The soil borings were performed using a truck-mounted drill rig equipped with a standard hammer. Split-barrel samples were obtained in the soil below the bottom of the augers in general accordance with the Standard Method for Penetration and Split-Barrel Sampling of Soils. Samples were collected at 2.5 feet intervals to 10 feet below grade, and every 5 feet thereafter. After recovery, the samples were removed from the split-spoon sampler, visually reviewed and classified, placed in glass jars and transported to our laboratory for additional review.

Soil samples stored for extended periods are susceptible to moisture loss and are no longer indicative of the conditions originally encountered in the soil borings. Therefore, soil samples are usually stored in our laboratory for a period of 60 days, unless instructed otherwise.

Soil boring logs were prepared based on field notes and visual classification of the samples in the laboratory. Indicated on each soil boring log is the description of each stratum observed, the approximate depth and/or elevation of each stratum change observed, Standard Penetration Test resistance values, and the observed groundwater levels. The soil boring logs are presented in Appendix B.

LABORATORY PROCEDURES

The laboratory testing program included supplementary visual classification of the samples in general accordance with the Unified Soil Classification System. The following two pages describe the soils classification procedure.

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

Per ASTM D 2487—00
(Based on Unified Soil Classification System)

Soil Description: Secondary Soil Type BASIC SOIL TYPE, Consistency/Relative Density, Color, Supplemental Soil Type, Moisture, Miscellaneous comments.

Ex. Silty SAND, loose, brown, fine to medium, trace gravel, moist.

Secondary Soil Type – adjective for the BASIC SOIL TYPE describing material making up greater than 12% but less than 50% of the primary soil type by weight. For sands this also includes a description of grain size (fine, medium or coarse).

BASIC SOIL TYPE – primary constituent of sample; material making up greater than 50% of the sample by weight. Material is classified by grain size and material properties.

Consistency/Relative Density – a measurement of in-situ consistency or density of cohesive or cohesionless soils, respectively, based upon Standard Penetration Testing blow counts (N) per ASTM D 1586.

Color – visual inspection of soil appearance.

Supplementary Soil Type – a description of any other material that may be mixed with the BASIC SOIL TYPE. Qualifying terms are based on the percentage of the supplementary soil type in the sample by weight.

Moisture – description of the in-situ moisture content of the sample (dry, moist or wet).

Miscellaneous Comments – anything observed in the sample or in the field that does not fit into the above categories but should be noted (odor, etc.).

CALIBRATED AUTO HAMMER CONSISTENCY/RELATIVE DENSITY				
COHESIONLESS SOILS		COHESIVE SOILS		
SPT N-VALUES	IN-SITU RELATIVE DENSITY	SPT N-VALUES	SHEAR STRENGTH (PSF)	IN-SITU CONSISTENCY
0-3	VERY LOOSE	0-1	BELOW 250	VERY SOFT
4-8	LOOSE	2-3	250 - 500	SOFT
9-23	MEDIUM DENSE	4-6	500 - 1,000	MEDIUM STIFF
24-38	DENSE	7-12	1,000 - 2,000	STIFF
>38	VERY DENSE	13-25	2,000 - 4,000	VERY STIFF
		>26	OVER 4,000	HARD

STANDARD HAMMER CONSISTENCY/RELATIVE DENSITY				
COHESIONLESS SOILS		COHESIVE SOILS		
SPT N-VALUES	IN-SITU RELATIVE DENSITY	SPT N-VALUES	SHEAR STRENGTH (PSF)	IN-SITU CONSISTENCY
0-4	VERY LOOSE	0-2	BELOW 250	VERY SOFT
5-10	LOOSE	3-4	250 - 500	SOFT
11-30	MEDIUM DENSE	5-8	500 - 1,000	MEDIUM STIFF
31-50	DENSE	9-16	1,000 - 2,000	STIFF
>50	VERY DENSE	17-32	2,000 - 4,000	VERY STIFF
		>32	OVER 4,000	HARD

SUPPLEMENTAL TEXTURE QUALIFYING TERMS	
DESCRIPTOR	PERCENTAGE BY WEIGHT
TRACE	1-10%
LITTLE	10-20%
SOME	20-35%
AND	35-50%

SOIL CLASSIFICATION CHART (Per ASTM D2487)

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

A Based on the material passing the 3-in. sieve

B If field sample contained cobbles or builders, or both, add "with cobbles or boulders or both" to group name

C Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

D Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

E $Cu = D_{60}/D_{10}$ $Cc = (D_{30})^2/(D_{10}*D_{60})$

F If soil contains ≥ 15% sand, add "with sand" to group name.

G If fines classify as CL-ML, use dual symbol GC-GM or SC-SM

H If fines are organic, add "with organic fines" to group name.

I If soil contains ≥ 15% gravel, add "with gravel" to group name.

J If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant

L If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.

M If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name

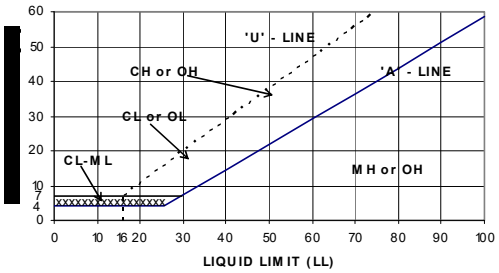
N PI ≥ 4 and plots on or above 'A' line.

O PI < 4 or plots below 'A' line.

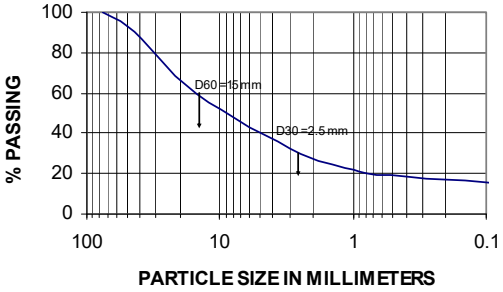
P PI plots on or above 'A' line.

Q PI plots below 'A' line.

For classification of fine-grained soils and fine-grained fraction of coarse-grained soils



SIEVE ANALYSIS



Local Agency Programs
Hot Mix Asphalt (HMA) Selection Guidelines
Revised: 11/01/2017
FHWA Approved: 12/26/2017

The following guidelines have been developed at the request of Local Agency Engineers for use on Local Agency projects. These guidelines have been reviewed and approved by the County Road Association of Michigan Engineering Committee. Previous experience and performance shall permit variations from these guidelines as per Sect D: Alternative Mixes**.**

A. HMA Mixture Type and Binder Selection

Selection is based on present day two-way commercial ADT. The commercial ADT ranges for each of the mixture types have taken into account an assumed future traffic growth rate.

Com. ADT.	Com. ADT 0-300	Com. ADT 301-700	Com. ADT 701-1000	Com. ADT 1001-3400	Com. ADT 3401- 9999
Mixture Type					
Top	LVSP or 13A, 36A	4C 5E1/4E1	5E3, or 4E3	5E10, or 4E10	5E30, or 5E10
Leveling	LVSP or 13A	3C 4E1	4E3	4E10	4E30
Base	13A / 3C	2C / 3C	3E3	3E10	3E30
Binder Grades by Region					
Superior	PG 58-34	PG 58-34	PG 58-34	PG 58-34	
Metro	PG 58-22	PG 64-22	PG 64-22	PG 64-22	PG 70-22P
All Other	PG 58-28	PG64-28	PG-64-28	PG64-28	PG70-28P

Note 1: If the designer wishes to reduce the target air voids on projects to 3.5%, a note needs to be added to the plans on the HMA Application Table stating that the air voids have been changed to 3.5% for that particular project for top and leveling courses. For mixtures meeting the definition of base course, field regress air void content to 3.0 percent with liquid asphalt cement unless specified otherwise on HMA application estimate.

Note 2: The mixture type in each traffic category listed in the above table is specifically designed to perform under their respective Commercial ADT. Selecting a mixture type that is specifically designed for a higher Comm. ADT than the project being designed may adversely affect performance.

Note 3: One course overlays on composite pavements where the prevention of cold temperature related thermal cracking is not as much of a concern, the cold temperature number of the PG binder may be decreased by one grade to help reduce costs.

Example: For a one course overlay in the Superior Region on a composite project, the recommended PG binder would be a PG58-28 instead of a PG58-34.

Note 4: To address traffic areas that are more susceptible to rutting early in pavements life such as signalized intersections and other areas of stop/start traffic use the pay item entitled **High Stress Hot Mix Asphalt Mixture**. The difference between the High Stress HMA Mixture and the typical HMA pay item is the Performance Graded binder. For High Stress Mixtures, increase the high temperature binder by one grade and add the polymer. The increase in the high temperature number results in an asphalt binder with improved high temperature stiffness or rutting resistance for both the leveling and top course.

Example: For a high stress application for a mixture type 5E3 placed in an intersection the recommended binder grade would be a PG70-28P instead of a PG64-28. Following are the recommend guides for the proper application of the Special Provision for High Stress Hot Mix Asphalt Mixture:

a. Use this pay item 1000 feet on either side of the center of signalized intersections and other areas where stop/start traffic occurs on the mainline (for quantity calculations use 1100 feet).

b. There are cases where the signalized intersections are spaced 1 mile or less over the entire length of the project. When this occurs, specify the High Stress HMA Mixture pay item for the entire length.

c. All HMA approaches that are adjacent to the High Stress HMA Mixture areas should be specified using this pay item.

d. Use of the Pay Item High Stress HMA (mix), should not be used unless it is to be distinguished from the same mix with a different PG grade.

B. Application Rates

HMA application rates shown in the table below are the required minimum and maximum rates for each of the specific mixtures. Pavement designs requiring a HMA greater than the recommended maximum will require multiple lifts of the leveling and/or base mixes.

Mixture Type	Marshall Mixture					**Superpave Mixture**				
	36A	13A	2C	3C	4C	LVSP	3E_	4E1	4E3+	5E_
Min. #/syd	110	165	350	220	165	165 Top or Leveling	330	165	220	165
Max. #/syd	165	275	500	330	275	220 Top 250 Leveling	410	330	275	220

Note 1: Application rate of 110 #/syd. per 1-inch thickness.

Note 2: When shoulders of 8 ft. or greater are being paved as a separate operation on a project, the following note should be added to the plans near the HMA Application Table; "For shoulders only, the mix design and/or JMF target value for Air Voids are to be adjusted to 2.5 percent." If it is not known whether the shoulders will be placed as a separate paving operation, the note should be added.

C: Aggregate Wear Index (All Projects)

Aggregate Wear Index (AWI) is required for all aggregates used in HMA top course mixtures. The following table identifies the required minimum AWI, based on the present average daily traffic (vehicular and commercial) per lane (ADT/Lane):

ADT/Lane	**Minimum AWI**
<100	None
100 - 2000	220
>2000	260

D: Alternative Mixes

These guidelines provide for the selection of Hot Mixed Asphalt (HMA) and application rates utilizing the Superpave mix design system along with the Marshall Mix design system. The substitution of another HMA mixture type other than the recommended mixture is acceptable if it has demonstrated to perform under similar traffic conditions. If a local agency desires to use an HMA mixture or grade of binder other than what is contained within this guide, they must submit the change in writing. The letter or email must include the alternate mix design, the justification/reason for the change, and a statement that they accept responsibility for the outcome of the performance of the mix design that is used in lieu of the recommended mixture.

E. Non-Motorized Path Mixes

When designing a Non-Motorized Path, recommended HMA Mixes that have historically worked well include:

Superpave mixes:

HMA, LVSP

HMA, 5E_

Shared Use Path, HMA Snowmobile Wearing Cse – Special (See: 12DS806(F355))

Marshall mixes:

HMA, 13A

HMA, 36A

No AWI is required on the top course, however, if the designer wishes, he or she can use the Aggregate Wear Index (AWI) of 220 minimum.

Use PG 58-28 for all mixes, except for HMA, 5E_, which should be PG 64/28.

Application rates should match the chart on the previous page (page 3 of 4).

F. Non-Motorized Path Alternative Mixes

If a local agency desires to use an HMA mixture or grade of binder other than what is contained within this guide, or if they propose another pavement treatment or type, they must submit the change request to the LAP Staff Engineer in writing. The letter or email must include the alternate mix design, or pavement treatment, the justification and/or reason for the change, and a statement that they accept responsibility for the outcome of the performance of the mix design that is used in lieu of the recommended mixture.

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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.

C. _____

D. 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. MODIFICATIONS TO AIA C106

D. ARTICLE 3 – LICENSE CONDITIONS

E. 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.

END OF DOCUMENT 00 6324

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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

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SECTION 01 2300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
2. The Schedule of Alternates does not specifically list all possible items affected by each alternate, review all documents for additional items.

B. Execute accepted alternates under the same conditions as other work of the Contract.

C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Tensile Fabric Shade Structures.

1. Base Bid: No Tensile Fabric Shade Structures.

2. Alternate: Provide Tensile (Fabric) Shade Structures south of the building as shown on Sheet L201.

B. Alternate No. 2: Wood Gymnasium Flooring.

1. Base Bid: Provide Resilient Athletic Flooring in the Gymnasium. Refer to Interiors Sheets, including but not limited to I001 and I101D and Section 09 6566 Resilient Athletic Flooring. Provide a standard wet pipe fire suppression system.
2. Alternate: Provide Wood Athletic Flooring in the Gymnasium in lieu of Resilient Flooring. Provide Rubber Vent-Cove Base with extended horizontal leg. Refer to Interiors Sheets including but not limited to I001 and I101D and Section 09 6466 Wood Athletic Flooring. Lower the concrete top of slab elevation as noted on Structural Drawings. Provide a pre-action fire suppression system in the Gym in lieu of a standard wet pipe system

C. Alternate No. 3: Radiant Heat in Floors.

1. Base Bid: No Radiant Heat in Floors.
2. Alternate: Provide Radiant Heat in concrete floors as shown on Mechanical Drawings. See specifications section 23 8316 Radiant Heating Hydronic Piping. Provide additional underslab insulation, refer to drawings.

END OF SECTION 01 2300

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01 2300 "Alternates" for products selected under an alternate.
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.

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 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: Architect will consider requests for substitution if received within 20 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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 supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 , Architect's Supplemental Instructions, or on a similar form of the Architect’s choosing..

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 Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

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

1.4 ALLOWANCES

A. Allowance Adjustment: Base each Change Order Proposal Request for an allowance cost adjustment solely on the difference between the actual purchase amount and the allowance, multiplied by the final measurement of work in place, with reasonable allowances, where applicable, for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in the purchase amount only where indicated as part of the allowance.
2. When requested, prepare explanations and documentation to substantiate the margins claimed.
3. Submit substantiation of a change in scope of work claimed in the Change Orders related to unit cost allowances.
4. The Owner reserves the right to establish the actual quantity of work in place by independent quantity survey, measure, or count.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Unit-Price Adjustment: See Construction Managers documents Unit Prices for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 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 G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2600

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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. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Project meetings.

B. Related Requirements:

1. Construction Managers requirements for "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
2. Construction Managers requirements for "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
3. Construction Managers requirements for "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
4. Construction Managers requirements for "Closeout Procedures" for coordinating closeout of the Contract.
5. Construction Managers requirements for “Project Meetings”

1.2 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 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.

1.4 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. Owner's Project number.
4. Name of Architect.
5. Architect's Project number.
6. Date.
7. Name of Contractor.
8. RFI number, numbered sequentially.
9. RFI subject.
10. Specification Section number and title and related paragraphs, as appropriate.
11. Drawing number and detail references, as appropriate.
12. Field dimensions and conditions, as appropriate.
13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
14. Contractor's signature.

15. 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 Action: Architect will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for approval of Contractor's means and methods.
   d. Requests for coordination information already indicated in the Contract Documents.
   e. Requests for adjustments in the Contract Time or the Contract Sum.
   f. Requests for interpretation of Architect's actions on submittals.
   g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect 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 in writing within five 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.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

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

1.5 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. 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 2022.
4. 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."

B. 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.

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

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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. Construction Managers requirements for "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. Construction Managers requirements for "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 01 4000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
5. Section 01 7700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.

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 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 final release or approval.
   g. Scheduled dates for purchasing.
   h. Scheduled date of fabrication.
   i. Scheduled date for shipment of products.
   j. Scheduled dates for installation.
   k. 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 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. Architect 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 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.

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.

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.

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 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 will review each submittal, indicate corrections or revisions required, and return it.

1. PDF Submittals: Architect 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 will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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, 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.

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, in order to provide the highest quality and performance. 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 a statement 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.

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, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Notify Architect 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 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 and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the 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:

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.

B. Engage testing and inspection services except where indicated as by Owner in other Specification Sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 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.
5. Submit log at Project closeout as part of Project Record Documents.

3.2 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. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "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. Conflicting Requirements: Where compliance with two or more standards is specified, or there is a conflict in the construction documents and where the standards or documents may establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement and refer requirements that are different but apparently equal and other uncertainties to the Architect for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements, in order to provide the highest quality and performance.. Refer uncertainties to the Architect for a decision before proceeding.

D. 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. Industry Organizations: 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. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; (see FGIA).
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; www.concrete.org.
9. ACP - American Clean Power; (Formerly: American Wind Energy Association); www.cleanpower.org.
10. ACPA - American Concrete Pipe Association; www.concretepipe.org.
11. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
12. AF&PA - American Forest & Paper Association; www.afandpa.org.
13. AGA - American Gas Association; www.aga.org.
14. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
15. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
16. AI - Asphalt Institute; www.asphaltinstitute.org.
17. AIA - American Institute of Architects (The); www.aia.org.
18. AISC - American Institute of Steel Construction; www.aisc.org.
19. AISI - American Iron and Steel Institute; www.steel.org.
20. AITC - American Institute of Timber Construction; (see PLIB).
21. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
22. AMPP - Association for Materials Protection and Performance; www.ampp.org.
23. ANSI - American National Standards Institute; www.ansi.org.

24. AOSA/SCST - Association of Official Seed Analysts (The)/Society of Commercial Seed Technologists (The); www.analyzeseeds.com.
25. APA - APA - The Engineered Wood Association; www.apawood.org.
26. APA - Architectural Precast Association; www.archprecast.org.
27. API - American Petroleum Institute; www.api.org.
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASA - Acoustical Society of America; www.acousticalsociety.org.
30. ASCE - American Society of Civil Engineers; www.asce.org.
31. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (see ASCE).
32. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
33. ASME - ASME International; [**American Society of Mechanical Engineers (The)**]; www.asme.org.
34. ASSE - ASSE International; (American Society of Sanitary Engineering); www.asse-plumbing.org.
35. ASSP - American Society of Safety Professionals; www.assp.org.
36. ASTM - ASTM International; www.astm.org.
37. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
38. AVIXA - Audiovisual and Integrated Experience Association; www.avixa.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWPA - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - Business and Institutional Furniture Manufacturer's Association; www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; www.bwfbadminton.com.
50. CARB - California Air Resources Board; www.arb.ca.gov.
51. CDA - Copper Development Association Inc.; www.copper.org.
52. CE - Conformite Europeenne (European Commission); www.ec.europa.eu/growth/single-market/ce-marking.
53. CEA - Canadian Electricity Association; www.electricity.ca.
54. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
55. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
56. CGA - Compressed Gas Association; www.cganet.com.
57. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
58. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
59. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
60. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
61. CPA - Composite Panel Association; www.compositepanel.org.
62. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
63. CRRC - Cool Roof Rating Council; www.coolroofs.org.
64. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
65. CSA - CSA Group; www.csagroup.org.
66. CSI - Cast Stone Institute; www.caststone.org.
67. CSI - Construction Specifications Institute (The); www.csiresources.org.
68. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
69. CTA - Consumer Technology Association; www.cta.tech.
70. CTI - Cooling Technology Institute; www.coolingtechnology.org.

71. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
72. DHA - Decorative Hardwoods Association; www.decorativehardwoods.org.
73. DHI - Door and Hardware Institute; www.dhi.org.
74. ECIA - Electronic Components Industry Association; www.ecianow.org.
75. EIMA - EIFS Industry Members Association; www.eima.com.
76. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
77. EOS/ESD - EOS/ESD Association, Inc.; Electrostatic Discharge Association; www.esda.org.
78. ESTA - Entertainment Services and Technology Association; www.esta.org.
79. EVO - Efficiency Valuation Organization; www.evo-world.org.
80. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
81. FGIA - Fenestration and Glazing Industry Alliance; https://fgiaonline.org.
82. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
83. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
84. FM Approvals - FM Approvals LLC; www.fmapprovals.com.
85. FM Global - FM Global; www.fmglobal.com.
86. FRSA - Florida Roofing and Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
87. FSA - Fluid Sealing Association; www.fluidsealing.com.
88. FSC - Forest Stewardship Council U.S.; www.fscus.org.
89. GA - Gypsum Association; www.gypsum.org.
90. GS - Green Seal; www.greenseal.org.
91. HI - Hydraulic Institute; www.pumps.org.
92. HMMA - Hollow Metal Manufacturers Association; (see NAAMM).
93. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
94. IAS - International Accreditation Service; www.iasonline.org.
95. ICC - International Code Council; www.iccsafe.org.
96. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
97. ICPA - International Cast Polymer Association (The); www.theicpa.com.
98. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
99. IEC - International Electrotechnical Commission; www.iec.ch.
100. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
101. IES - Illuminating Engineering Society; www.ies.org.
102. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
103. IGMA - Insulating Glass Manufacturers Alliance; (see FGIA).
104. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
105. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
106. Intertek - Intertek Group; www.intertek.com.
107. ISA - International Society of Automation (The); www.isa.org.
108. ISFA - International Surface Fabricators Association; www.isfanow.org.
109. ISO - International Organization for Standardization; www.iso.org.
110. ITU - International Telecommunication Union; www.itu.int.
111. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
112. LPI - Lightning Protection Institute; www.lightning.org.
113. MBMA - Metal Building Manufacturers Association; www.mbma.com.
114. MCA - Metal Construction Association; www.metalconstruction.org.
115. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
116. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
117. MHI - Material Handling Industry; www.mhi.org.
118. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
119. MPI - Master Painters Institute; www.paintinfo.com.

120. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry, Inc.; www.msshq.org.
121. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
122. NACE - NACE International; (National Association of Corrosion Engineers International); (see AMPP).
123. NADCA - National Air Duct Cleaners Association; www.nadca.com.
124. NAIMA - North American Insulation Manufacturers Association; www.insulationinstitute.org.
125. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
126. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
127. NBI - New Buildings Institute; www.newbuildings.org.
128. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
129. NCMA - National Concrete Masonry Association; www.ncma.org.
130. NEBB - National Environmental Balancing Bureau; www.nebb.org.
131. NECA - National Electrical Contractors Association; www.necanet.org.
132. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
133. NEMA - National Electrical Manufacturers Association; www.nema.org.
134. NETA - InterNational Electrical Testing Association; www.netaworld.org.
135. NFHS - National Federation of State High School Associations; www.nfhs.org.
136. NFPA - National Fire Protection Association; www.nfpa.org.
137. NFPA - NFPA International; (see NFPA).
138. NFRC - National Fenestration Rating Council; www.nfrc.org.
139. NGA - National Glass Association (The); www.glass.org.
140. NHLA - National Hardwood Lumber Association; www.nhla.com.
141. NLGA - National Lumber Grades Authority; www.nlga.org.
142. NOFMA - National Oak Flooring Manufacturers Association; (see NWFA).
143. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
144. NRCA - National Roofing Contractors Association; www.nrca.net.
145. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
146. NSF - NSF International; www.nsf.org.
147. NSI - Natural Stone Institute; www.naturalstoneinstitute.org.
148. NSPE - National Society of Professional Engineers; www.nspe.org.
149. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
150. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
151. NWFA - National Wood Flooring Association; www.nwfa.org.
152. NWRA - National Waste & Recycling Association; www.wasterecycling.org.
153. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
154. PDI - Plumbing & Drainage Institute; www.pdionline.org.
155. PLASA - PLASA; www.plasa.org.
156. PLIB - Pacific Lumber Inspection Bureau; www.plib.org.
157. PVCPA - Uni-Bell PVC Pipe Association; www.uni-bell.org.
158. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
159. RFCI - Resilient Floor Covering Institute; www.rfci.com.
160. RIS - Redwood Inspection Service; (see WWPA).
161. SAE - SAE International; www.sae.org.
162. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
163. SDI - Steel Deck Institute; www.sdi.org.
164. SDI - Steel Door Institute; www.steeldoor.org.
165. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
166. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (see ASCE).
167. SIA - Security Industry Association; www.securityindustry.org.
168. SJI - Steel Joist Institute; www.steeljoist.org.

169. SMA - Screen Manufacturers Association; www.smainfo.org.
170. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
171. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
172. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
173. SPIB - Southern Pine Inspection Bureau; www.spib.org.
174. SPRI - Single Ply Roofing Industry; www.spri.org.
175. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
176. SSINA - Specialty Steel Industry of North America; www.ssina.com.
177. SSPC - SSPC: The Society for Protective Coatings; (see AMPP).
178. STI/SPFA - Steel Tank Institute/Steel Plate Fabricators Association; www.steeltank.com.
179. SWI - Steel Window Institute; www.steelwindows.com.
180. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
181. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
182. TCNA - Tile Council of North America, Inc.; www.tcnatile.com.
183. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.kbcdco.tema.org.
184. TIA - Telecommunications Industry Association (The); www.tiaonline.org.
185. TMS - The Masonry Society; www.masonrysociety.org.
186. TPI - Truss Plate Institute; www.tpinst.org.
187. TPI - Turfgrass Producers International; www.turfgrasssod.org.
188. TRI - Tile Roofing Industry Alliance; www.tileroofing.org.
189. UL - Underwriters Laboratories Inc.; www.ul.org.
190. UL LLC - UL LLC; www.ul.com.
191. USAV - USA Volleyball; www.usavolleyball.org.
192. USGBC - U.S. Green Building Council; www.usgbc.org.
193. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
194. WA - Wallcoverings Association; www.wallcoverings.org.
195. WCLIB - West Coast Lumber Inspection Bureau; (see PLIB).
196. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
197. WDMA - Window & Door Manufacturers Association; www.wdma.com.
198. WI - Woodwork Institute; www.woodworkinstitute.com.
199. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
200. WWPA - Western Wood Products Association; www.wwpa.org.

C. 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.

D. 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. CPSC - U.S. Consumer Product Safety Commission; www.cpsc.gov.
2. DOC - U.S. Department of Commerce; www.commerce.gov.
3. DOD - U.S. Department of Defense; www.defense.gov.
4. DOE - U.S. Department of Energy; www.energy.gov.
5. DOJ - U.S. Department of Justice; www.ojp.usdoj.gov
6. DOS - U.S. Department of State; www.state.gov.
7. EPA - United States Environmental Protection Agency; www.epa.gov.

8. FAA - Federal Aviation Administration; www.faa.gov.
9. GPO - U.S. Government Publishing Office; www.gpo.gov.
10. GSA - U.S. General Services Administration; www.gsa.gov.
11. HUD - U.S. Department of Housing and Urban Development; www.hud.gov.
12. LBNL - Lawrence Berkeley National Laboratory; Energy Technologies Area; www.lbl.gov/.
13. NIST - National Institute of Standards and Technology; www.nist.gov.
14. OSHA - Occupational Safety & Health Administration; www.osha.gov.
15. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
16. USACE - U.S. Army Corps of Engineers; www.usace.army.mil.
17. USDA - U.S. Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
18. USDA - U.S. Department of Agriculture; Rural Utilities Service; www.usda.gov.
19. USP - U.S. Pharmacopeial Convention; www.usp.org.
20. USPS - United States Postal Service; www.usps.com.
21.

E. 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 U.S. Government Publishing Office; www.govinfo.gov.
2. DOD - U.S. Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
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.dsp.dla.mil/Specs-Standards/.
    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from U.S. 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).
9.

F. 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. BEARHFTI; California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; (see BHGS).
2. BHGS; State of California Bureau of Household Goods and Services; (Formerly: California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation); www.bhgs.dca.ca.gov.
3. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.oal.ca.gov/publications/ccr/.
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.

5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; https://tfsweb.tamu.edu/.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 4200

SECTION 01 4500
QUALITY ASSURANCE: STRUCTURAL TESTING AND INSPECTION

PART 1 - GENERAL

1.1 GENERAL

A. Quality assurance is testing and inspection to assist the Owner in evaluating the Contractor's performance and quality control in the fabrication shop and field. It is not a substitute for the testing and inspection which is required as part of the Contractor's quality control program.

B. Cost: Except as specifically noted otherwise, the testing agency for quality assurance shall be engaged and paid by the Owner.

1. The Owner has negotiated inspection services based upon the assumption that all fabrication work shall be performed at one single fabrication shop. Costs associated with work being performed in additional shops will require reimbursement to the Owner.

C. Definitions:

1. See Sections 03 3000 and 05 1200.
2. The term “Testing Agency” in this Specification section is defined as an independent testing and inspection service engaged by the Owner for quality assurance testing and inspection of structural construction in accordance with applicable building code provisions and any additional activities listed in the Contract Documents.
3. The term “Geotechnical Engineer” in this Specification section is defined as an independent geotechnical engineering service engaged by the Owner for quality assurance testing and inspection of the actual soil conditions to verify compliance with the geotechnical conditions, recommendations and design values described in the Project Geotechnical Report and used as the basis of design for the most current Contract Documents.

1.2 SCOPE

A. Testing Agency shall provide qualified personnel at the site to test and inspect materials installed by and work performed by the Contractor, for the following structural items as indicated in Part 3 of this Specification section:

1. **Section 03 1000 Concrete Formwork**
2. **Section 03 2000 Concrete Reinforcement and Embedded Assemblies**
3. **Section 03 3000 Cast-In-Place Concrete**
4. **Section 03 4100 Precast Structural Concrete: Hollow-Core**
5. **Section 04 2200 Concrete Masonry Units**
6. **Section 05 1200 Structural Steel**
7. **Section 05 2000 Steel Joists**
8. **Section 05 3000 Steel Deck**

B. Refer to the drawings for Special Inspections requirements for the Project. The Special Inspections shown on the drawings may contain additional testing and inspection that is not listed in this specification section.

1.3 TESTING AGENCY QUALIFICATIONS

A. Testing Agency shall be an independent agency with the experience and capability to conduct testing, inspection and sampling as indicated in accordance with ASTM E 329.

B. Testing Agency shall be an agency approved by the local building official to perform Special Inspections and other related services as outlined in the governing project Building Code.

C. Testing, inspection, and sampling shall be done in accordance with the applicable ASTM standards.

D. Personnel performing visual inspection and non-destructive testing of welds shall meet the requirements of AWS D1.1 for weld inspectors and shall have current certification as an AWS Certified Welding Inspector.

1.4 TESTING AGENCY RESPONSIBILITIES

A. Provide qualified personnel at the site to test and inspect structural construction as the work progresses using the most current Contract Documents and approved shop drawings.

B. Provide additional testing and inspection as needed due to the following:

1. Work performed contrary to Drawings and Specifications
2. Work performed with improper supervision
3. Work performed without prior notice

C. Report deficiencies to Contractor, Owner, Design Professionals within 24 hours.

D. Rejection: The Testing Agency has the right to reject any material at any time, when it is determined that the material or workmanship does not conform to the Contract Documents and shall immediately notify the Owner, Design Professionals, and Contractor of deficiencies. Failure to detect any defective work or material shall not prevent later rejection when such a defect is discovered nor shall it obligate Design Professionals for final acceptance.

E. Noncompliance Log: Indicate to the Contractor where remedial work must be performed and maintain a current log of work not in compliance with the Contract Documents. This noncompliance log shall be submitted to the Design Professionals and Owner on a weekly basis.

F. Reports: Prepare daily inspection, observation, and/or test reports as required herein and provide an evaluation statement in each report stating whether or not the work conforms to requirements of Specifications and Drawings and shall specifically note deviations from them. The daily reports shall be collected and submitted for record to the Design Professionals and Owner weekly.

G. Certification: Upon completion of work and resolution of remedial items, certify in a letter to the Design Professionals and Owner, that the installation is in accordance with the requirements of the Drawings and Specifications.

1.5 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall have sole responsibility for coordinating their work with the Testing Agency to assure that all test and inspection procedures required by the Contract Documents and Public Agencies are provided. The Contractor shall cooperate fully with the Testing Agency in the performance of their work and shall provide the following:

1. Information as to time and place of starting shop fabrication and field construction/erection, at least one week prior to the beginning of the work.
2. The most up to date construction schedule.
3. At least 24 hours advance notice of work requiring testing and inspection.
4. Access to areas as required for testing and inspection.
5. Site File: At least one copy of the most current Contract Documents and approved shop drawings shall be kept available in the contractor's field office. Drawings not bearing evidence of approval and release for construction by the Design Professionals shall not be kept on the job. Provide drawings for the work to be performed in the shop or field one week prior to the start of work.
6. Representative material samples requested by the Testing Agency for testing, if necessary.
7. Full and ample means of assistance for testing and inspection of material.
8. Facilities for proper storage of material samples as required.
9. Proper facilities, including scaffolding, temporary work platforms, safety equipment etc., for inspection of the work in shop and field.

B. Immediately notify the Owner's Testing Agency and Design Professionals in writing of conditions that will adversely affect the work.

C. Materials and installed work may require testing and retesting at any time during progress of work, as directed by Design Professionals. Tests, including retesting of rejected materials for installed work will be done at Contractor's expense.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Testing Agency shall provide qualified personnel at site to test and inspect structural construction using the latest Contract Documents and approved submittals as indicated in the following sections.

3.2 CONCRETE FORMWORK

A. Quality Assurance:

1. Prior to placement of reinforcement, inspect formwork for grade, quality of material, absence of foreign matter, and other imperfections that might affect concrete placement and tolerances stated herein.
2. Inspect formwork for shape, location and dimensions of the concrete member being formed.
3. Inspect formwork for compliance with specified tolerances, block outs, camber, shoring ties and seal of form joints.

4. Verify condition of bond surfaces, locations and sizes of all accessories, embedment items, and anchorage for prevention of displacement.
5. Verify proper use/application of form release agents.
6. Verify in-situ concrete strength meets requirements for formwork removal in specification section 03 1000 prior to removal of shores and formwork from beams and structural slabs.
7. Inspect concrete surfaces immediately after removal of formwork and prior to any patching or repair work.

3.3 CONCRETE REINFORCEMENT AND EMBEDDED ITEMS

A. Quality Assurance:

1. Prior to placement, inspect reinforcement and embeds for grade, quality of material, absence of foreign matter, and for suitable storage.
2. Provide continuous inspection of reinforcement and embedded assemblies during placement and immediately prior to concreting operations for: size, quantity, vertical and horizontal spacing and location, correctness of bends and splices, mechanical splices, clearances, compliance with specified tolerances, security of supports and ties, concrete cover, and absence of foreign matter.
3. Inspect epoxy-coated reinforcement for coating damage and required applied coatings.
4. Provide continuous inspection of adhesive anchors installed in horizontal or upwardly inclined orientations and those marked (CERT) on the latest Drawings.
5. Adhesive anchors shall be proof tested in tension as follows:

    a) Testing Agency shall submit an adhesive anchorage proof testing plan to the SER for review and approval prior to performing the anchor proof testing. The anchorage testing plan shall meet the requirements as specified in this section and indicate which anchors have been selected for testing.
    b) Proof testing shall be performed as a confined tension test in accordance with the guidelines of ASTM E488 and the requirements of ACI 355.4.
    c) Testing shall be performed after the minimum curing period specified by the manufacturer.
    d) **[5,10, or 25]** percent of each type and size of an adhesive anchor assembly and 100 percent of anchors marked (CERT) shall be proof tested in tension by the Owner's Testing Agency.
    e) All anchors selected for proof testing shall be production anchors. Sacrificial anchors are not acceptable for inclusion in the proof testing plan unless specifically approved by the SER prior to performance of the testing.
    f) The adhesive anchors proof tension loads shall be as specified in the general notes of the structural drawings.
    g) Anchors shall have no visible indications of displacement or damage during or after proof load application. Concrete cracking in the vicinity of the anchor after loading shall be considered a failure.
    h) If more than **[10%]** of the tested adhesive anchors fail to achieve the specified proof load, **[100%]** of the anchors of the same diameter and type as the failed anchor shall be proof tested, unless otherwise direct in writing by the SER. Immediately notify the SER of all failed proof tests.

6. Mechanical post-installed anchors shall be proof tested as follows:

    a) Testing Agency shall submit a mechanical anchorage proof testing plan to the SER for review and approval prior to performing the anchor proof testing. The anchorage testing plan shall meet the requirements as specified in this section and indicate which anchors have been selected for testing.

b) **[5,10, or 25]** percent of each type and size of mechanical anchor shall be proof tested by the Owner's Testing Agency. The required proof test for the anchors is as follows:
c) For torque-controlled mechanical anchors, a proof torque shall be applied to the anchor using a calibrated torque wrench and the proof torque shall be achieved with no more than one-half turn of the anchor nut.
d) The required proof torque load for torque-controlled mechanical anchors shall be as specified in the general notes of the structural drawings.
e) All anchors selected for proof testing shall be production anchors. Sacrificial anchors are not acceptable for inclusion in the proof testing plan unless specifically approved by the SER prior to performance of the testing.
f) Concrete cracking in the vicinity of the anchor during or after proof torque load application shall be considered a failure.
g) If more than **[10%]** of the tested mechanical anchors fail to achieve the specified proof torque load or set, **[100%]** of the anchors of the same diameter and type as the failed anchor shall be proof tested, unless otherwise direct in writing by the SER. Immediately notify the SER of all failed proof tests.

7. Periodic inspection for post-installed adhesive and mechanical anchors shall be provided in accordance with the building code except that continuous inspection shall be provided for the conditions identified in section A.4. The inspector shall observe all aspects of the anchor installation and shall, at a minimum, verify the following items:

a) Hole drilling method in accordance with the Manufacturer's Published Installation Instructions (MPII) and these installation requirements.
b) Anchor spacing and edge distance.
c) Hole diameter and depth.
d) Hole cleaning in accordance with the MPII.
e) Anchor element type, material, diameter, and length.
f) For adhesive anchors, adhesive identification and expiration date.
g) For adhesive anchors, adhesive installation in accordance with the MPII.
h) For torque-controlled mechanical anchors, the number of turns required to achieve the anchor set torque per the MPII.

3.4 CAST-IN-PLACE CONCRETE

A. Quality Assurance:

1. Monitor concrete placement as follows:
a) Verify use of required design mix
b) Record location of point of concrete discharge of each batch truck tested, cross referenced to grid lines.
c) Record temperature of concrete at time of placement.
d) Record weather conditions at time of placement, including temperature, wind speed, relative humidity, and precipitation.
e) Record types and amounts of admixtures added to concrete at the project site.
f) Record amount of water added at the site and verify that total water content does not exceed amount specified in the mix design. Addition of water at the site is subject to prior approval by the Design Professional.
g) Monitor consistency and uniformity of concrete.

h) Monitor preparation for concreting operations, placement of concrete, and subsequent curing period for conformance with Specifications for following procedures:
   i. Concrete curing.
   ii. Hot weather concreting operations.
   iii. Cold weather concreting operations.

2. Conduct tests of concrete as follows and in accordance with ASTM C 1077:

a) Testing frequency: Sample sets for all tests listed below of each concrete design mix placed each day shall be taken not less than once a day, nor less than once for each 100 **[50]** cubic yards. (75 **[40]** cubic meters) of concrete, nor less than once for each 5000 **[2500]** square feet (500 **[250]** square meters) of surface area for slabs or walls. Additional tests shall be performed if deemed necessary by the Owner's Testing Agency and Design Professionals. In addition, sample each truckload used for columns, regardless of other frequencies listed above.
b) Obtain each test sample from different batches selected on a strictly random basis before commencement of concrete placement. Record location in structure of sampled concrete.
c) Determine air content of normalweight concrete in accordance with either ASTM C 231 or ASTM C 138. Determine air content of lightweight concrete in accordance with ASTM C 173. Conduct one test for air content for each strength test required or for every 50 cubic yards (40 cubic meters) of fly ash concrete placed, whichever is less.
d) Determine unit weight of lightweight concrete in accordance with ASTM C 567.
e) Test water content of freshly mixed concrete on a random basis, a minimum of once per 100 cubic yards (75 cubic meters) or every 5000 square feet (500 square meters) of concrete placement, during placement in accordance with AASHTO T 318 for the following concrete types:
   i. Hard troweled slabs exposed to view
   ii. Slab to receive a bonded finish floor material
   iii. Slabs with specified concrete compressive strength exceeding 6000 psi (42MPa)

f. Conduct slump tests in accordance with ASTM C 143.
g. Slump indicated in mix designs shall be achieved at point of placement. Correlation between slump at point of initial discharge from truck and point of placement must be established to determine amount of slump loss which occurs between initial discharge and point of placement. Adjustment may be necessary to achieve slump indicated in mix designs at point of placement.
h. Conduct slump tests for Self Consolidating Concrete (SCC) as follows
   i. In accordance with ACI 237, where SCC is used, perform slump flow and visual stability index tests in accordance with ASTM C1611 on the first batch of SCC, and then consecutive batches until two consecutively produced batches are within specification. SCC with a visual stability index value of 2 or 3 shall be stabilized, where possible, with a viscosity modifying admixture or rejected at the discretion of the Engineer and Ready Mix Quality Control Representative. The Ready Mix Producer shall be responsible for adjusting the mix to provide desired flow and stability. After establishing the consistency of the SCC mix, testing shall continue in accordance with the requirements of the above paragraph.
   ii. In accordance with ACI 237, where SCC is used, perform slump flow tests in accordance with ASTM C1621 using a J-ring to determine the passing ability of the SCC mix around reinforcement. If the reinforcing bars retain the coarse aggregates inside the ring, the mixture has a high potential for blocking and should be reproportioned at the direction of the Engineer and Ready Mix Quality Control Representative.

i. Conduct strength tests of concrete as follows:

i. Secure sample sets in accordance with ASTM C 172.
ii. Mold cylinders in accordance with ASTM C 31 and cure under standard moisture and temperature conditions in accordance with ASTM C 31, Section 7 (a). Quantity of cylinders listed below is based on a cylinder size of 4 inch (100mm) diameter x 8 inches (200mm) long. If 6 inch (150mm) diameter by 12 inch (300mm) long cylinders are used, the total quantity of cylinders may be reduced by one with two cylinders instead of three tested at the age designated for determination of f'c.
iii. Test cylinders in accordance with ASTM C 39. For specified concrete strength of 10,000 psi (70MPa) and above, cylinders shall be ground and not capped.
iv. For 28 day mixes mold six cylinders. Test two cylinders at seven days and three cylinders at 28 days. The 28 day strength shall be the average of the three 28 day cylinders. One cylinder shall be retained in reserve for later testing if required.
v. For 56 day mixes mold seven cylinders. Test one cylinder at seven days, two cylinders at 28 days, and three cylinders at 56 days. The 56 day strength shall be the average of the three 56 day cylinders. One cylinder shall be retained in reserve for later testing if required.
vi. For 90 day mixes mold eight cylinders. Test one cylinder at seven days, one at cylinder at 28 days, two cylinders at 56 days, and three cylinders at 90 days. The 90 day strength shall be the average of the three 90 day cylinders. One cylinder shall be retained in reserve for later testing if required.
vii. When early age concrete strength verification is required by the Contractor for formwork removal or stressing of post-tensioning tendons, strength shall be verified, at the Contractor's expense, by additional compression tests of field-cured cylinders or by the maturity method in accordance with ASTM C1074.
viii. If one cylinder in a test manifests evidence of improper sampling, molding or other damage, discard cylinder and base test results on that of remaining cylinder.

3. Evaluate concrete for conformance with Specifications as follows:

a. Slump:
i. Maintain a slump moving average, comprised of the average of all batches or most recent five (5) batches tested, whichever is fewer.

b. Strength test:

i. Maintain a compressive strength moving average, comprised of three (3) consecutive strength test results, for each mix design used in work.
ii. Strength level of concrete will be considered satisfactory provided averages of all sets of three (3) consecutive strength test results (i.e. moving average) equal or exceed specified 28-day strength, and no individual strength test result falls below specified 28-day strength by more than 500 psi (3.5MPa).
iii. If strength tests fail to meet minimum requirements, concrete represented by such tests shall be considered questionable and shall, if deemed appropriate by the SER, be subject to further evaluation by core testing as specified herein or other testing methods.
iv. Maintain a log that contains the results of all concrete strength tests. The log shall include the results of each test performed, be in electronic spreadsheet format, and updated and

submitted along with concrete test data. See example log attached at the end of this Specification Section.

c. Conduct core tests on questionable concrete in accordance with ACI 318 and ASTM C 42.

i. Location of cores shall be coordinated with Design Professionals so as to least impair strength of structure. Before testing cores, discard and replace any that show evidence of having been damaged subsequent to or during removal from structure or which have reinforcement present.

ii. Cores from structure exposed to soil or constant moisture in service (e.g. basement walls, retaining walls, slab-on-grade, piers, footings, etc.) shall be tested in a fully saturated condition. Cores for all other concrete may be tested dry. Prior to commencement of coring, verify with Design Professionals whether cores are to be tested wet or dry.

iii. Fill core holes with low slump concrete or mortar with a strength equal to or greater than that specified for area cored.

d. Concrete in area represented by core test will be considered adequate if average strength of cores is equal to at least 85% of, and if no single core is less than 75% of specified strength.

4. Floor flatness and levelness tolerance compliance testing is to be performed within 72 hours of concrete placement by Testing Agency, and prior to the removal of shores and forms.

A. Testing Agency to test and report flatness (F_F), levelness (F_L) prior to shoring removal. For slabs that include camber, do not test for levelness (F_L). Perform F_F/F_L testing in accordance with ASTM E 1155 requirements.

EXAMPLE CONCRETE STRENGTH SPREADSHEET LOG

AVERAGE DIAMETER (IN)	AVERAGE CROSS-SECTIONAL AREA (IN^2)	BREAKING LOAD (LB)	BREAK TYPE **	AVERAGE COMPRESSIVE STRENGTH (PSI)						
4	12.56	165990	Type 1	13210						

SPECIMEN I.D.	TICKET NUMBER	PLACEMENT LOCATION	MIX I.D.	CURE TYPE*	DATE TESTED	AGE AT TEST (DAYS)
S0002	1234	First Floor Slabs and Beams	H3651	I, CA, CB	3/8/2106	7
						14
						28
						56

3.5 PRECAST STRUCTURAL CONCRETE: HOLLOW-CORE

A. Field Inspection: Acceptance of erected precast concrete will be made by the Design Professionals for general conformance with the plans and specifications.

B. Defective Work: Precast concrete units which do not conform to specified requirements, including strength, tolerances, and finishes, shall be repaired or replaced with precast concrete units that meet requirements of this section as directed by the Design Professionals. The Contractor shall also be responsible for the cost to any other work affected by or resulting from corrections to precast concrete work.

C. Acceptance Criteria of Concrete Strength: The compressive strength level of an individual class of concrete shall be considered satisfactory if the following requirements are met:

1) The average of all sets of three consecutive strength tests equal or exceed the required f'c.
2) No individual strength test falls below the required f'c by more than 500 psi.
3) If criteria 1 above is not met but criteria 2 above has been, the Contractor shall immediately notify the Design Professionals and take immediate steps to increase the average of subsequent strength tests.

D. Testing and Inspection will be in accordance with PCI MNL-116 Requirements.

E. Precast producer shall allow Testing Agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Testing Agency and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.

F. Compressive strength shall be based on tests of cylinders made and tested in accordance with the CAST-IN-PLACE CONCRETE section of this Specification.

G. Quality Assurance:

4) Evaluate precast producer's quality control and testing methods. Quality control inspection and testing shall occur during the manufacture of the components.
5) Precast producer shall allow Testing Agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Testing Agency and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation
6) Before shipment, all precast components shall be inspected to make certain the materials and workmanship conform to the requirements of the contract documents and shop drawings. Copy of the written inspection reports shall be submitted for record to the Contractor and Design Professional.
7) Strength of precast concrete units will be considered potentially deficient when precast concrete units fail to comply with requirements, including the following:
    a) Fail to meet compressive-strength test requirements. Concrete strength will be considered deficient if a cylinder strength test falls more than 500 psi below the required f'c. All units cast from the concrete that is represented by the low strength test shall be considered potentially deficient and subject to tests or replacement.
    b) Failure to meet split cylinder strength requirements for lightweight concrete.
    c) Reinforcement, and pretensioning and detensioning tendons of prestressed concrete do not conform to fabrication requirements.
    d) Visual evidence of cracks exceeding .02 inches wide, excessive negative camber, or deflection in excess of calculated anticipated amounts.
    e) Concrete curing and protection of precast units not as specified.
    f) Concrete curing and protection of precast units against extremes in temperature fail to meet requirements.
    g) Precast units are damaged during handling and erecting.
8) When there is evidence that the strength of precast concrete units may be deficient or may not meet requirements, the Testing Agency will obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42.

    a) A minimum of 3 representative cores will be taken from precast concrete units of suspect strength, from locations directed by Design Professionals.
    b) Cores will be tested in an air-dry condition per ACI 301 when precast concrete units will be dry under service conditions.
    c) Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength is at least 85 percent of the 28-day design

compressive strength and no core compressive strength is less than 75 percent of the 28-day design compressive strength.

d) Test results will be made in writing on the same day that tests are made, with copies to Design Professionals, Contractor, and precast fabricator. Test reports will include the Project identification name and number, date, name of precast concrete fabricator, name of concrete testing agency; identification letter, name, and type of precast concrete unit or units represented by core tests; design compressive strength, compressive strength at break and type of break, corrected for length-diameter ratio, and direction of applied load to core with respect to horizontal plane of concrete as placed.

e) Where core test results are satisfactory and precast concrete units meet requirements, solidly fill core holes with patching mortar and finish to match adjacent concrete surfaces.

9) Visually inspect all field welds and test according to ASTM E 165 or ASTM E 709. High-strength bolted connections will be subject to inspections.

H. X-Rays: The Design Professionals may order x-rays taken of any member if there is sufficient doubt about the proper existence or location of reinforcing steel, embedded items, or strands.

I. Load Tests: The Design Professionals may order a load test of the member in the plant or in the field if there is sufficient evidence to question the structural integrity of the member.

J. Except as specifically approved, the following is a partial list of finish defects and/or problems which are not acceptable in high quality exposed precast concrete and are means for rejection and replacement of precast pieces. These items must be corrected in manufacturing or design procedures.

1) Ragged or irregular edges.
2) Excessive air pits and voids evident on exposed surface.
3) Adjacent flat and return surfaces with more than slight difference in exposure.
4) Casting lines evident from different placements.
5) Visible form joints or irregular surfaces.
6) Rust staining on surfaces.
7) Components not matching approved sample or non-uniformity of color within a component.
8) Areas of light or heavy aggregate concentration.
9) Blocking or acid stains evident on surface.
10) Non-uniformity of texture.
11) Embedded foreign material.
12) Reinforcement shadow lines.
13) Damaged edges and surfaces.

3.6 CONCRETE MASONRY UNITS

A. Quality Assurance:

1. Testing Requirements:

e. Mortar:

i. Testing Frequency: At the beginning of all masonry work take at least one test sample on three successive working days and at least one week intervals thereafter. Additional samples shall be taken whenever any change in materials or job conditions occur.
ii. Test compressive strength and air content test in conformance with ASTM C780.

f. Grout: The following testing requirements are for grout proportions determined by specified compressive strength only:

i. Testing Frequency: Samples of grout shall be taken for each mix design, each day grout is placed, and not less than every 5,000 square feet (465 square meters) of masonry wall surface area or fraction thereof.
ii. Test compressive strength in conformance with ASTM C1019.
iii. For self-consolidating grout also perform slump flow and Visual Stability Index (VSI) in conformance with ASTM C1611.

g. Compressive strength of masonry (f'm), unit strength method:

i. Testing Frequency: Prior to masonry construction and for every 5,000 square feet (465 square meters) of masonry wall surface area or fraction thereof.
ii. Sample and test units to verify conformance with ASTM C90.
iii. Thickness of bed joints does not exceed 5/8" (15.9 mm)
iv. Verify grout conforms to ASTM C476.

2. Inspection Requirements:
a. Inspect and verify the following items periodically unless otherwise noted as continuous. Periodic inspections shall be random and unannounced and shall occur at least once per week. Where items are noted as continuous, inspections shall be performed whenever and wherever the work is being performed.

i. Compliance with approved submittals

ii. At beginning of CMU construction, verify the following:

1. Proportions of site-prepared mortar.
2. Construction of mortar joints.
3. Location of reinforcement and connectors.
4. Block unit size.

iii. Prior to grouting, verify the following:

1. Grout space.
2. Grade, type, and size of reinforcement and anchor bolts.
3. Placement of reinforcement and connectors.
4. Proportions of site-prepared grout.
5. Construction of mortar joints.
6. Bond pattern.
7. Tie-in at intersecting walls.
8. Condition of block units after placement.
9. Bond beam and/ or tie beam locations, reinforcement, and lap splice lengths.

iv. During CMU construction, verify the following:

1. Size and location of structural elements.
2. Type, size, and location of anchors and/or embedments, including other details of connection of masonry to structural members, frames, or other construction.
3. Welding of reinforcement (continuously inspect).
4. Preparation, construction, and protection of masonry during cold weather or hot weather. For cold and hot weather requirements see Section 04 2200.
5. Placement of grout (continuously inspect).
6. Lintel size, location, and bearing lengths.

v. Observe preparation of grout specimens, mortar specimens, and/or prisms.

b. Inspections will also include verification that:

i. Materials are properly stored.
ii. Installation is within specified construction tolerances.
iii. Proper mortar ingredients and mixing techniques are being used.
iv. Mortar time on board is within specified limits.
v. Joints are being properly tooled.
vi. Flashing assembly is being properly fabricated and installed.
vii. Weeps and vents are being installed and are functional.
viii. Control joints are being installed as indicated, or, as specified.

3.7 STRUCTURAL STEEL

A. Quality Assurance:

1. Shop inspection shall include alignment and straightness of members, camber, preparation for connections, dimensional checks, testing of shop bolts, witnessing of welding procedures, testing of cuts, weld access holes and copes of Heavy Sections as defined in this Specification, examination and testing of completed welds, headed studs and deformed bar anchors, cutting of Heavy Sections, finishing of column ends, cleaning, painting and storage of material. All shop fabrication shall be inspected in the shop. Camber shall be verified in a minimum of 10% of all members requiring camber. If, in the opinion of the SER and Testing Agency this testing discloses a large ratio (10% or more) of unacceptable cambers, the required percentage of tested cambers may be increased by the SER to 100% at no expense to the Owner. Where testing is required for less than 100% of locations, select test locations at random and throughout the project.
2. Field inspection shall include connections, proper tensioning of bolts, levelness, plumbness and alignment of the frame, conformance to AWS welding methods, examination of surface before welding, examination and testing of completed welds, headed studs and deformed bar anchors and field painting, including touch-up. Where testing is required for less than 100% of locations, select test locations at random and throughout the project.
3. Review the following items in the shop and field:

a) Welding certificates, procedures, and personnel
b) Stud welding setup and operators; bolting procedure and crew
c) Bolting procedure and crew
d) Mill certifications for compliance with the Contract Documents.

4. Inspect high strength bolted construction in accordance with RCSC "Specification for Structural Joints using ASTM A 325 or A 490 Bolts," including but not limited to:

    e) Surface preparation and bolt type conforms to plans and Specifications prior to start of bolting operations.
    f) Proper bolt storage and handling procedures per codes and standards referenced by this Specification are being followed.
    g) Visually inspect all bolted connections.
    h) For all bolted connections that are indicated as snug tight, connections are properly compacted and brought to the snug tight condition progressing outward from the most rigid part.
    i) For all bolted connections that are indicated as pretensioned or slip critical, pre-installation verification testing is performed by the inspector in cooperation with the contractor in accordance with RCSC section 9.2 and section 7.
    j) For all bolted connections that are indicated as pretensioned or slip critical, through routine observation, as defined in RCSC 9.2.1, 9.2.3 or 9.2.4, that the pretensioning methods of RCSC 8.2.1, 8.2.3, or 8.2.4, as appropriate, are performed.

        i. "Routine observation" is defined as observation of 10 bolts for every 100 bolts with a minimum of 2 bolts per connection.

    k) Retest bolted connections that fail initial inspection after correction by the Fabricator or Erector.

5. Test and inspect welding and welded construction including but not limited to:

    a) Review of submittals:

        i. Review all Welding Procedures prepared by the Contractor's Engineer or Certified Welding Engineer. Verify the accuracy of all essential variables of the Welding Procedure including but not limited to confirmation that weldability and heat induction for Heavy Sections and high restraint welds comply with AWS requirements.
        ii. Review of welding procedures including prequalification, qualifications test and, for Heavy Sections and High Restraint Welds, the welding procedure prepared by the Contractor's Engineer or Welding Consultant
        iii. Submit for record a report indicating that the Welding Procedures have been reviewed as indicated above to the Design Professionals.

    b) Test all complete joint penetration welds for soundness by means of either radiographic or ultrasonic testing in accordance with AWS D1.1 and ASTM E164 procedures. All flaws in plate or flange material revealed during such tests shall be repaired and retested by the Contractor at the Contractor's expense.
    c) Test all partial joint penetration welds for soundness by means of visual and magnetic particle inspection, unless other methods are specified in the Contract Documents. All flaws in plate or flange material revealed during such tests shall be repaired and retested by the Contractor at the Contractor's expense.
    d) Testing of welds at Heavy Sections and High Restraint Welds shall be performed not less than 48 hours after the weld has been completed.

e) Visually inspect all fillet welds. In addition test ten percent (10%) of all fillet welds using a non-destructive method, such as dye penetrant or magnetic particle. Select test locations randomly throughout the structure, but test at least one weld in each location with 6 or more welds per connection. If, in the opinion of the SER and Testing Agency this testing discloses a large ratio (10% or more) of unacceptable welds, the required percentage of tested welds may be increased by the SER to 100%, all at the Contractor's expense.

f) Inspection and Testing by the Testing Agency of High Restraint Welds and where Heavy Sections are to be joined by partial or complete joint penetration welds in tension:

1) Joint Preparation: Monitor fit up and joint preparation (bevel angle, etc.) for conformance to the submitted welding procedures including preheat and interpass temperature. Monitor base metal temperature during welding operations.
2) Test Complete Joint Penetration Welds in accordance to the requirements of this Specification section, ultrasonically in accordance with AWS D1.1 procedures. On T or corner joints, pay careful attention to the heat affected zone and base metal where the weld shrinkage stresses are in the through thickness direction.
3) Test Partial Joint Penetration Butt Joints in accordance with this Specification section by the magnetic particle method. At T or corner joints, in addition to the magnetic particle testing, ultrasonically scan the heat affected zone and adjacent base metal from face "C" per AWS D1.1 Table 6.7 and Annex Q7 to detect lamellar tears and shall be done with a compression wave. The Testing Agency shall submit a testing procedure that includes evaluation (acceptance criterion) procedures to the Design Professionals for review.

g) At Heavy Sections and High Restraint Welds: provide pre-production sample testing of heat treatment, observe fabrication, welding and heat treatment of the samples for conformance with submitted welding procedures. Establish locations of testing coupons following AWS procedures. Test coupons following AWS procedures to verify satisfactory results using the welding procedure and heat treatment.

6. Visually inspect all headed studs and deformed bar anchors for complete fusion and full 360-degree weld flash (or fillet).

a) Check all studs with incomplete fusion, and at random five studs at each of six beams per floor, by bending to an angle of 15 degrees from its original axis (away from any missing flash). If more than twenty percent of studs fail on one member, check all studs on member. In addition, for each member with any defective studs, test an additional member.
b) Contractor to replace any studs that crack or break. Contractor to only straighten studs that would foul other work or have less than 1 inch (25mm) cover in bent position.

7. Cleaning & Painting:

a) Examine shop painting to verify conformance with this Specification.
b) Examine loading and unloading of steel to visually observe that damage does not occur during shipping and handling.

3.8 STEEL JOISTS

A. Quality Assurance:

1. Review mill certifications for compliance with the Contract Documents.
2. Review welders' qualification to determine compliance to Specifications.
3. Review welding procedures to determine compliance to Specifications.
4. Visually inspect weld quality, size and length
5. Visually inspect paint.
6. Verify that inspections required by manufacturer have been performed, and any corrections required as a result of inspections have been completed.
7. Inspect erected joists for damage.
8. Visually inspect placement of erected steel joists including:

    a) Proper seat bearing
    b) Welding from seat to support
    c) Bolted and welded field connections
    d) Bridging installation
    e) Spacing

9. Submit inspection reports and state in each report whether or not **[fabrication and]** erection conform**[s]** to requirements of Specification and Drawings and shall specifically note deviations from them.

B. Joist manufacturer responsibilities:

1. Owner reserves the right to engage Owner's Testing Agency to perform shop inspections at any time during fabrication.
2. Notify Contractor and Testing Agency seven (7) days in advance of start of shop fabrication and three (3) days in advance of initial field delivery.
3. Comply with instructions of Testing Agency to correct deficiencies in materials and welding work as provided in Contract Documents.
4. Make available to Testing Agency lists showing identification marks, number of each different type of joist required, overall length, components size, ASTM designation of materials, camber and shop paint.

3.9 STEEL DECK

A. Quality Assurance:

1. Decking is subject to inspection and testing once connected in place:

    a) Expense of removing and replacing any portion of decking for testing purposes will be borne by the Owner if connections are found to be satisfactory.
    b) Contractor shall remove work found to be defective and provide acceptable work at no additional cost to the Owner.

2. Field inspect all steel deck after erection for the following:

    a) Proper deck profile, type (acoustic, cellular, vented), gage and finish
    b) Correct deck orientation, alignment, bearing and laps (if applicable)
    c) Supplementary items including secondary supports, closures, pour stops, sumps and their connections to deck and to other members

d) Damage of members during transportation, storage and erection
e) Proper installation and erection
f) Proper deck to supporting member and deck to deck connections (quantity, size, spacing and quality of welds/fasteners) including inspection of deck welding

3. Field inspect headed studs (shear connectors) as follows:

a) At the start of each day's operations for welding headed studs, the Contractor shall first weld a minimum of two studs to demonstrate proper welding set up for that day's typical deck and support conditions. Testing Agency to observe Contractor hammer-bending the studs to an angle 15 degrees from the vertical without weld failure.
b) Should failure occur in the weld zone of either stud, Contractor shall adjust welding set up and repeat the test until two consecutive studs are, tested and found satisfactory before any production welding of studs may begin.
c) Perform demonstration tests at each significant change in conditions including deck thickness, deck coating (painted to galvanized) or number of deck layers.
d) Do not weld studs through more than one layer of steel deck, except where cellular deck is specified.
e) Failed test studs shall be removed and replaced by production studs.
f) During production installation, bend testing of headed studs is required where incomplete weld flash is observed, and at random locations on each floor. For production testing requirements see Section 05 1200.

3.10 FOOTINGS

A. Quality Assurance by Geotechnical Engineer (or Testing Agency if the same entity):

1. Review Contractor's proposed footing installation methods, sequences, and procedures.
2. Verify bearing stratum and bearing capacity of each footing; verify levelness of footing end bearing surface.
3. Determine final bearing elevation at each footing location.
4. Observe, record, and report footing as-built plan location, footing size and final elevations of bottom (where possible) and top of completed footings.
5. Coordinate with Testing Agency.

B. Quality Assurance by Testing Agency:

1. Inspection of Batch Plant: As required to ensure that concrete delivered to job complies with Specifications and design mix. Batch plant inspection shall be required once at start of job and thereafter if concrete falls below Specifications.
2. Inspection of Reinforcement: Provide continuous visual inspection of site fabrication. Record the steel reinforcement bar sizes, grade, length, and number of bars.
3. Inspection of Concrete and Reinforcement Placement: Provide continuous visual inspection of installation of reinforcement and concrete placement including verification of laitance removal at top of footings.
4. Check ready mix delivery tickets for correct concrete mix design number. Record batch to placement time. Check slump, temperature, and batch to placement time for each set
5. Slump Tests: ASTM C143. Make one test from each truck.
6. Concrete Compressive Strength Tests: Testing agency will take a minimum of one sample set of concrete cylinders per 20 cubic yards of concrete. See CAST-IN-PLACE CONCRETE section of this

specification for requirements. Cure cylinders to simulate same curing conditions as concrete in footings. Reports of cylinder tests shall state footing location(s), laboratory or site curing, compression strength, type of fracture, age at testing, concrete supplier, mix specification strength, any other pertinent information, test results, and conclusions.

7. Additional Tests: Perform additional testing if, in the opinion of the Design Professionals, concrete of poor quality has been placed based on cylinder strengths below Specification requirements or visual defects. Tests may be compression tests on cored cylinders, ASTM C42, and load tests as outlined in ACI 318, or as directed by the Design Professionals. Complete continuous coring of footings will be required, at Contractor's expense, where verification of quality of concrete is not otherwise attainable.

END OF SECTION

SECTION 01 5639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes tree protection zone fencing, and general protection/pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Requirements:

1. Section 01 5000 "Temporary Facilities and Controls" for temporary site fencing.
2. Section 31 1000 "Site Clearing" for removing existing trees and shrubs.
3. Section 32 9300 “Plants” for replacing damaged trees within protection zones.

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.

B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape or the average of the smallest and largest diameters at a height 54 inches above the ground line for trees with caliper of 8 inches or greater as measured at a height of 12 inches above the ground.

C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings defined defined by a circle concentric with each tree with a radius 12 times the tree's caliper size and with a minimum radius of 96 inches unless otherwise indicated <Insert requirement>.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
   a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.

b. Arborist's responsibilities.
c. Quality-control program.
d. Coordination of Work and equipment movement with the locations of protection zones.
e. Trenching by hand or with air spade within protection zones.
f. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
2. Detail fabrication and assembly of protection-zone fencing and signage.
3. Indicate extent of trenching by hand or with air spade within protection zones.

C. Samples: For each type of the following:

1. Organic Mulch: 1-quartvolume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
2. Protection-Zone Fencing: None required.
3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

D. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.7 QUALITY ASSURANCE

A. Arborist Qualifications: Must have at least three of the following

1. Certified Arborist as certified by ISA.
2. Certified Arborist-Municipal Specialist as certified by ISA.
3. Licensed arborist in jurisdiction where Project is located.
4. Current member of ASCA Registered Consulting Arborist as designated by ASCA.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.8 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

D. Tree Protection Warranty:

1. Conditions. If, within a period of two years after date of substantial completion, any tree or trees in protection areas die or suffer significant loss due to damage caused by improper tree protection to the protection zone, or the tree itself, then the Contractor shall pay for all costs associated with fully removing and replacing the tree.
    a. Removal will include (but not be limited to) trimming, cutting, hauling away, stump grinding, excavation, backfill, replacement, staking, guying, and inclusion of full new tree warranty according to Section 32 9300 “Plants”.

2. Replacements:
    a. See FIELD QUALITY AND CONTROL section near the end of this specification.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Stockpiled soil mixed with planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

1. Mixture: Well-blended mix of two parts stockpiled soil to one part planting soil.
2. Planting Soil: Planting soil as specified in Section 32 9300 “Plants”.

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:

1. Wood Protection-Zone Fencing: Constructed of two 2-by-4-inch horizontal rails, with 4-by-4-inch preservative-treated wood posts spaced not more than 96 inches apart, and lower rail set halfway between top rail and ground.
   a. Height: 48 inches.
   b. Lumber: Comply with requirements in Section 06 1000 "Rough Carpentry." Previously used materials may be used when approved by Architect.

2. Gates: Single- or Double- swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

1. Size and Text: As shown on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Tie a 1-inch blue vinyl tape around each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.

1. Apply 2-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

3.3 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
2. Access Gates: Install where needed; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 35 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete, and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 31 2000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not paint cut root ends.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Section 31 2000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.

1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
    a. Type of Pruning: Cleaning, raising, reducing, and thinning where indicated.
    b. Specialty Pruning: Structural restoration vista and utility where indicated.

B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

F. Chip removed branches and spread over areas identified by Architect or stockpile in areas approved by Architect, unless the branches are diseased or otherwise could cause deleterious effects to any impacted portion of the project as identified by Arborist.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Small Trees: Provide one new tree of 4-inch caliper size for each tree that measures 12 inches or smaller in caliper size.
2. Large Trees: Provide one new tree of 8-inch caliper size for each tree being replaced that measures more than 12 inches in caliper size.
   a. Species: As selected by Architect.

3. Plant and maintain new trees as specified in Section 32 9300 "Plants."

C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch uniform thickness to remain.

D. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 01 5639

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 2300 "Alternates" for products selected under an alternate.
2. Section 01 2500 "Substitution Procedures" for requests for substitutions.
3. Section 01 4200 "References" for applicable industry standards for products specified.
4. 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.

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.

PART 3 - EXECUTION (Not Used)

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. Starting and adjusting.
6. 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.
3. Section 07 8413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 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, 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.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 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, 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.

C. 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. 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.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 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. If discrepancies are discovered, notify Architect and Construction Manager promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
    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.

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.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Where possible, 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.

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. Fit exposed connections together to form hairline joints.

J. Remove and replace damaged, defective, or non-conforming Work.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching of the material being cut and patched. 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 according to 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. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

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. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
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.
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 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. 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.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 7300

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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.
5. Repair of the Work.

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 specified in 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 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 specific warranties, 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.
    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 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 according to 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. Submit warranties including those specified in individual 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. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. 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 on digital media acceptable 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. General: 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, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are 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. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. 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.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment[**, elevator equipment,**] and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. 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.
p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations, before requesting inspection for determination of Substantial Completion.

B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 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.

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 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 will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect'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 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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 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.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

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 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 sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. 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. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect through Construction Manager for resolution.
4. 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. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Format: Annotated PDF electronic file with comment function enabled.
3. 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.
4. 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 deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

PART 2 - PRODUCTS

PART 3 - EXECUTION

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.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 01 7900

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SECTION 01 9113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Commissioning: Commissioning is a quality oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meet defined objective and criteria. The commissioning process includes specific tasks to be conducted during the project in order to verify that design, construction, and training meets the construction/contract documents.

C. Commissioning 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.
3. Verify that O&M documentation left on site is complete.
4. Verify that the Owner's operating personnel are adequately trained.

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. Section 22 0800 "Commissioning of Plumbing" for technical commissioning requirements for plumbing.
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)
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. Basis of Design (BoD): A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

C. 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.

D. Commissioning Plan (Cx Plan): A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process

E. 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.

F. 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).

G. Factory Testing: Testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.

H. 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.

I. 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.

J. 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").

K. Non-Compliance: See Deficiency.

L. Non-Conformance: See Deficiency.

M. 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."

N. Owner's Project Requirements (OPR): A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

O. Prefunctional Checklist (PC): A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CxA to the Sub. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). The word prefunctional refers to before functional testing. Prefunctional checklists augment and are combined with the manufacturer's start-up checklist. Even without a commissioning process, contractors typically perform some, if not many, of the prefunctional checklist items a commissioning authority will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing, and does not witness much of the prefunctional check listing, except for larger or more critical pieces of equipment.

P. Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.

Q. Seasonal Performance Tests: FT that are deferred until the system(s) will experience conditions closer to their design conditions.

R. 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).

S. 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.

T. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

U. Startup: The initial starting or activating of dynamic equipment, including executing prefunctional checklists.

V. Subs: The subcontractors to the GC who provide and install building components and systems.

W. Test Procedures: The step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CxA.

X. Trending: Monitoring using the building control system.

Y. Vendor: Supplier of equipment.

Z. Warranty Period: Warranty period for entire project, including equipment components.

1.4 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.

1.5 COMMISSIONING PROCESS

A. Commissioning Plan: The *Commissioning Plan*, provided as part of the bid documents, is binding on the Contractor. The commissioning plan provides guidance in the execution of the commissioning process. The *Specifications* will take precedence over the *Commissioning Plan*.

B. Commissioning Process: The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

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. The construction checklists are to be prepared and completed by the contractor or subcontractor before and during the startup process.
5. Installation verification is executed by the CxA.
6. Construction checklists, installation verification checklists, TAB and startup must be completed before functional performance testing.
7. Items of non-compliance in material, installation, or setup shall be corrected at no expense to the Owner.
8. The contractor ensures that the subcontractors construction checklists are executed and documented and that startup and initial checkouts are performed. The CxA verifies that the TAB, construction checklists and startups were completed according to the plans. This includes the CxA

reviewing TAB reports, construction checklists and startup plans/checklists. This also includes witnessing startup of selected equipment. 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.

9. Draft O&M's are submitted.
10. Owner training plans are submitted.
11. The CxA develops and implements equipment and system functional performance test procedures. The forms and procedures are reviewed by the commissioning team.
12. 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.
13. The CxA concurrently with the design team and Owner reviews the O&M documentation for completeness.
14. Commissioning shall be completed before substantial completion with the exception of deferred testing.
15. The contractor develops procedures, reviews, coordinates, and implements the training.
16. Deferred testing is conducted as specified or required.

1.6 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. Fire Suppression.
2. Plumbing.
3. HVAC sheet metal.
4. HVAC piping.
5. Test and Balance.
6. DDC.
7. Electrical.
8. Fire Alarm.

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.

1.7 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

D. Attend commissioning scoping meetings and additional meetings as necessary.

1.8 OWNERS REPRESENTATIVE'S RESPONSIBILITIES (IF APPLICABLE)

A. The Owner's Representative OR shall represent the Owner during the commissioning process as follows:

1. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the *Commissioning Plan.*
2. Provide final approval for the completion of the commissioning work.
3. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.
4. Attend commissioning scoping meetings and additional meetings as necessary.

1.9 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.

1.10 CONSTRUCTION MANAGER'S (CM) RESPONSIBILITIES (IF APPLICABLE)

A. The construction manager shall participate in and perform commissioning process activities including, but not limited to the following:

1. 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.
2. Attend commissioning team meetings.
3. Perform the normal review of Contractor submittals.
4. 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.
5. Review commissioning progress and deficiency reports.

6. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.

1.11 CONTRACTOR'S RESPONSIBILITIES

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. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
3. Attend commissioning team meetings.
4. Integrate and coordinate commissioning process activities with construction schedule.
5. Review commissioning progress and deficiency reports.
6. Complete paper or electronic construction checklists as Work is completed and provide to the CxA.
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 all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
13. 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.
14. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
15. Review test procedures for equipment installed by factory representatives.

1.12 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.

1.13 CxA'S RESPONSIBILITIES

A. The CxA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CxA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E. The primary role of the CxA is to develop and coordinate the execution of a testing plan, observe and document performance—that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied and installed by the CxA.

1. 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.
2. Coordinate the commissioning work and, with the GC and CM, ensure that commissioning activities are being scheduled into the master schedule.
3. Revise, as necessary, the Commissioning Plan.
4. Plan and conduct a commissioning meetings.
5. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
6. Write and distribute prefunctional tests and checklists.
7. Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.
8. Approve prefunctional tests and checklist completion by reviewing prefunctional checklist reports and by selected site observation and spot checking.
9. 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. Submit to CM for review, and for approval if required.
10. Analyze any functional performance trend logs and monitoring data to verify performance.
11. Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
12. Maintain a master deficiency and resolution log and a separate testing record.
13. Witness performance testing of smoke control systems by others and all other owner contracted tests or tests by manufacturer's personnel over which the CxA may not have direct control. Document these tests and include this documentation in Commissioning Record in O&M manuals.
14. Oversee the training of the Owner's operating personnel.
15. Compile and maintain a commissioning record and building systems book(s).
16. Review and approve the preparation of the O&M manuals.
17. Provide a final commissioning report.
18. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.

1.14 SYSTEMS TO BE COMMISSIONED

A. Refer to individual Divisions' commissioning sections for systems that are to be commissioned.

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 the OPR and BoD.
2. Review installed systems, subsystems, and equipment.
3. Instructor qualifications.
4. Instructional methods and procedures.
5. Training module outlines and contents.
6. Course materials (including operation and maintenance manuals).
7. Locations and other facilities required for instruction.
8. Training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
9. 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. General. Prefunctional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

C. 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. Parties responsible for prefunctional checklists and startup are identified in the commissioning scoping meeting and in the checklist forms.

1. These checklists and tests are provided by the CxA to the Contractor. The Contractor determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form will have more than one trade responsible for its execution.
2. The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the CxA's checklists with 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 CxA's prefunctional checklists.
    b. 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.
    c. The manufacturer's normally used field checkout sheets.
3. The full start-up procedures and the approval form may be provided to the CM for review and approval, depending on management protocol.

D. 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:

Sensor	Required Tolerance (+/-)	Sensor	Required Tolerance (+/-)
Cooling coil, chilled and condenser water temps	0.4F	Flow rates, water	4% of design
		Relative humidity	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
Watthour, 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.

E. Execution of Prefunctional Checklists and Startup.

1. The performance of the prefunctional checklists, startup and checkout are directed and executed by the Sub or vendor. When checking off prefunctional checklists, signatures may be required of other Subs for verification of completion of their work.
2. The Subs and vendors shall execute startup and provide the CxA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.
3. Only individuals that have direct knowledge and witnessed that a line item task on the prefunctional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

F. Deficiencies, Non-Conformance and Approval in Checklists and Startup.

1. The Subs shall clearly list any outstanding items of the initial start-up and prefunctional 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

A. **[The project will not require]**startup and initial checkout to be executed in phases.

B. **[The project requires]**TAB, startup and performance testing to be executed in phases. Phasing shall be coordinated with the owner/CM, CxA, and A/E and be reflected in the overall project schedule and

commissioning schedule by the contractor. Final performance testing of all systems will be as required by the phasing plan. The performance testing of the "systems as a whole" will be performed before final turnover of the entire project.

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. 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.
3. 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.
4. 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.
5. 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 TRAINING OF OWNER PERSONNEL

A. The Contractor shall provide training coordination, scheduling of subcontractors, and ensure that training is completed. All training shall be coordinated, through the CM, with the CxA.

B. The Contractor shall ensure that each subcontractor and vendor (mechanical, plumbing, fire, electrical, specialty, etc.) shall have the following responsibilities:

1. Provide, to the CxA through the CM, a training plan 60 days before the planned training covering the following elements:
   a. Equipment
   b. Intended audience
   c. Location of training
   d. Objectives
   e. Subjects covered (description, duration of discussion, special methods, etc.)
   f. Duration of training on each subject
   g. Instructor of each subject
   h. Methods (classroom lecture, manufacturer's quality video, site walk through, actual operational demonstrations, written handouts, etc.)

2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment that makes up the system.
3. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated at another scheduled time, if necessary.
5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment is required. More than one party may be required to execute the training.

6. The controls subcontractor shall attend sessions other than the controls training to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. The training sessions shall follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
8. Training shall include:
    a. Use of printed installation, operation and maintenance instruction material included in the O&M manuals.
    b. Systems manual
    c. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include startup, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
    d. Discussions of relevant health and safety issues and concerns.
    e. Discussion of warranties and guarantees.
    f. Common trouble shooting problems and solutions.
    g. Explanatory information included in the O&M manuals.
    h. Discussion of any peculiarities of equipment installation or operation.
    i. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
    j. Hands on training shall include startup, operation in all modes possible, including manual, shut down, alarms, power failure and any emergency procedures, and preventative maintenance for all pieces of equipment.

9. The Contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls not controlled by the central control system.

C. At the discretion of the CxA, training may occur before functional testing is complete if required by the facility operators to assist the CxA in the functional testing.

3.8 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 two draft copies of the complete operating and maintenance manual to the CM for review by the architect/engineer and CxA within 60 calendar days after review of equipment shop drawings. One copy will be returned to the contractor within 30 days after receipt by the A/E.
3. Contractor shall submit corrected final approved manuals prior to substantial completion. Prior to final submittal, the CxA shall review the O&M manuals (in addition to the initial draft O&M manual), and documentation, with redline as-builts, for systems that were commissioned to verify compliance with the specifications. The CxA will communicate, through the CM, deficiencies in the manuals to the contractor or A/E, as requested. Upon a successful review of the corrections, the CxA will recommend approval and acceptance of these sections of the O&M manuals to the CM. The CxA will also review each equipment warranty and verify that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.
4. A/E Contribution: The A/E will include in the beginning of the O&M manuals a separate section describing the systems including:

a. Simplified professionally drawn single line system diagrams on 8 ½" x 11" or 11" x 17" sheets. These shall include chillers, water system, condenser water system, heating system, supply air systems, exhaust systems and electrical distribution system. These shall show major pieces of equipment such as pumps, chillers, boilers, control valves, expansion tanks, coils, service valves, switchboards, motor control centers, panel boards, etc.

5. CxA Review and Approval: Prior to substantial completion, the CxA shall review the O&M manuals, documentation and redline as-builds for systems that were commissioned to verify compliance with the Specifications. The CxA will communicate deficiencies in the manuals to the CM, OR and A/E, as requested. Upon a successful review of the corrections, the CxA recommends approval and acceptance of these sections of the O&M manuals to the CM, OR and A/E. The CxA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.

B. Commissioning Record in O&M Manuals:

1. The CxA is responsible to compile, organize and index the following commissioning data by equipment into labeled, indexed and tabbed, three-ring binders and deliver it to the GC, to be included with the O&M manuals. Three copies of the manuals will be provided. The format of the manuals shall be:
   a. Tab I-1 Commissioning Plan.
   b. Tab I-2 Final Commissioning Report. Refer to "Final Report Details" article below..

2. Final Report Details. The final commissioning report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be 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. Other documentation will be retained by the CxA

3.9 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in various parts of the Specifications:

Product	Developed By
1. Final commissioning plan	CxA
2. Cx meeting minutes	CxA
3. Commissioning schedules	CxA with GC and CM
4. Equipment documentation submittals	Subs
5. Sequence clarifications	Subs and A/E as needed
5. Prefunctional checklists	CxA
6. Startup and initial checkout plan	Subs and CxA (compilation of existing documents)
7. Startup and initial checkout forms filled out	Subs

8.	Final TAB report	TAB
9.	Issues log (deficiencies)	CxA
10.	Commissioning Progress Record	CxA
11.	Deficiency reports	CxA
12.	Functional test forms	CxA
13.	Filled out functional tests	CxA
14.	O&M manuals	Subs
15.	Commissioning record book	CxA
16.	Overall training plan	CxA and CM
17.	Specific training agendas	Subs
18.	Final commissioning report	CxA
19.	Misc. approvals	CxA

END OF SECTION 01 9113

SECTION 03 1000
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to requirements of Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections.

1.2 SCOPE

Provide all labor, materials, equipment, services and transportation for formwork and related accessories required to complete all cast-in-place concrete work as shown on Drawings, as specified herein, and as required by the job conditions.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 4500
Concrete Reinforcement and Embedded Assemblies	Section 03 2000
Cast-In-Place Concrete	Section 03 3000
Thermal and Moisture Protection	Division 7

1.4 CODES AND STANDARDS

A. Building Code: Concrete work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 237 – Self Consolidating Concrete.
3. ACI 301 –Specifications for Structural Concrete.
4. ACI 318 – Building Code Requirements for Structural Concrete and Commentary.
5. ACI 347 – Guide to Formwork for Concrete.
6. ACI 347.2R – Guide for Shoring/Reshoring of Concrete Multistory Buildings

C. Definitions:

1. See Section 03 3000.

1.5 CONTRACTOR QUALIFICATIONS

A. The work of this section shall be performed by a company specializing in the type of concrete formwork required for this Project, with a minimum of 10 years of documented successful experience and shall be performed by skilled workers thoroughly experienced in the necessary crafts.

B. Contractor's testing agency Services: Required as specified in Division 1, and herein.

C. Materials and installed work may require testing and retesting at any time during progress of work, as directed by Design Professionals. Tests, including retesting of rejected materials for installed work will be done at Contractor's expense.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested.

1. Submittal Schedule
2. Shop Drawings
3. Shoring/Reshoring Calculations
4. Product Data
5. Samples
6. Compatibility Certification
7. Hazardous Materials Notification

8. **Submittal Schedule**: See Section 03 3000.
9. **Shop Drawings**:

a. Submit for action: Formwork shop drawings sealed and signed by a Professional Engineer licensed in the state where the project is located. Shop drawings shall clearly indicate but not be limited to the following:

1) Size, type and quality of form materials including conditions at tops and ends of walls. (If wood is used, indicate species.)
2) Form construction indicating structural stability and jointing including special form joints or reveals required by Contract Documents
3) Location and pattern of form tie placement, and other items that affect the appearance of concrete that will remain exposed to view.
4) Form finish clearly indicating proper locations and full coordination with concrete finishes required by Contract Documents.
5) Layout, procedures, and sequencing of shoring and reshoring that correlates with the information contained in the shoring/reshoring calculations described below.
6) Locations and dimensions of openings in structural members including floor slab, shear walls, columns and beams. See SUBMITTALS Section of Specification 03 3000.
7) Location of proposed construction joints in walls, floors, slabs, and beams. See SUBMITTALS Section of Specification 03 3000.

10. **Shoring/Reshoring Calculations**: Submit for record. Calculations sealed and signed by a Professional Engineer licensed in the state where the project is located. Calculations shall clearly address but not be limited to the following:

    a. Shoring removal and reshoring installation procedure including timing and sequencing.
    b. Concrete age and strength at the time of each shoring/reshoring operation.
    c. Description of construction loads assumed including concrete, formwork, and construction live load in accordance with ACI 347.
    d. Description of the distribution of construction loads between the shored/reshored levels.
    e. The total construction load imposed on all levels supporting shoring/reshoring at each stage of the shoring/reshoring cycle.
    f. A written statement by the Professional Engineer that the total construction load imposed on any level supporting shoring/reshoring, at all stages of the shoring/reshoring cycle, accounting for concrete age and relative strength at time of loading, meets the requirement of Section 3.2.

11. **Product Data**: Submit for action copies of manufacturers' product data and installation instructions for proprietary materials used in exposed concrete work, including form liners, release agents, manufactured form systems, ties, and accessories.
12. **Samples**: At request of Architect, submit for record samples of form ties and spreaders.
13. **Compatibility Certification**: Submit for record a written statement certifying that form release agent used is compatible with subsequent architectural finish materials applied to concrete surfaces. Submit along with manufacturer's data.
14. **Hazardous Materials Notification**: Submit for record. In the event no product or material is available that does not contain hazardous materials as determined by the Owner, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

B. Submittal Process: See Section 03 3000.

C. SER Submittal Review: See Section 03 3000.

D. Substitution Request: See Section 03 3000.

E. Request for Information (RFI): See Section 03 3000.

1.7 FORMWORK DESIGN

A. Design of Formwork, Shoring/Reshoring, and its removal is the Contractor’s responsibility.

B. Design, erect, support, brace and maintain formwork so that it will safely support vertical and lateral loads per SEI/ASCE 37-02 that might be applied, until such loads can be supported by the concrete structure.

C. Design Requirements:

1. Forms shall be designed for fabrication and erection in accordance with Design Professionals’ requirements and recommendations of ACI 301, 318 and 347

2. Design formwork in a manner such that the total construction load does not at any time exceed the total design load of new or existing construction and accounts for concrete age and relative strength at time of loading. See Section 3.2 for shoring/reshoring requirements.
3. Design formwork for loads and lateral pressures outlined in Section 2.2, ACI 347, and wind and seismic loads as specified by SEI/ASCE 37-02 unless otherwise controlled by local building code.
4. Design formwork to include loads imposed during construction, including weight of construction equipment, concrete mix, height of concrete drop, rate of filling of formwork, vibrator frequency, ambient temperature, foundation pressures, lateral stability, temporary imbalance or discontinuity of building components, and other factors pertinent to safety of structure during construction.
5. The use of flowing concrete (8" (200mm) to 10" (250mm) slump) of Self-Consolidating Concrete requires a review of the formwork design based on the rate of placement and setting time of the mix. Unless shown to be sufficient otherwise, formwork design shall conform to the requirements of ACI 237.

1.8 DELIVERY, storage, and HANDLINg

A. Comply with General Conditions and Division 1, including the following:

1. Store forms and form materials clear of ground and protect from damage.

1.9 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. See Section 01 4500.

1.10 QUALITY CONTROL BY CONTRACTOR

A. See Section 03 3000.

1.11 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. See Section 03 3000.

1.12 PERMITS AND WARRANTY

A. Permits: See Section 03 3000.

B. Warranty: See Section 03 3000. Failures include but are not limited to the following:

1. Discoloration of concrete scheduled to remain exposed to view.
2. Damage of concrete finishes caused by forms.
3. Damage of concrete caused by form stripping.
4. Non-compliance with form finishes required for designated architectural finishes.
5. Non-compatibility of form release agent with subsequent architectural finish materials applied to concrete surfaces.
6. Excessive and/or noticeable bowing in placed concrete members caused by deflection of formwork during concrete placement.

PART 2 - PRODUCTS

2.1 FORMWORK REQUIREMENTS

A. General Requirements:

1. Formwork shall meet construction safety regulations for the state where the project is located.
2. Forms shall be removable without impact, shock or damage to concrete surfaces, the structure and adjacent materials.
3. Forms shall be tight-fitting, designed and fabricated for required finishes and to withstand concrete weight and maintain tolerances as specified in ACI 117 for the following designations: (See architectural drawings for locations).

    a. Class A – For surfaces prominently exposed to public view where appearance is of special importance.
    b. Class B – Coarse-textured concrete-formed surfaces intended to receive plaster, stucco or wainscoting.
    c. Class C – General Standard for permanently exposed surfaces where other finishes are not specified.
    d. Class D - Minimum quality surface where roughness is not objectionable, usually applied where surfaces will be concealed.

4. Furnish forms in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings, using form materials with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
5. Butt Joints: Shall be solid and complete with backup material to prevent leakage of cement paste.

B. Form Finishes for Exposed Surfaces:

1. Type: Straight, smooth, free of cement paste leaks at butt-joints, surface imperfections and other irregularities detrimental to appearance of finished concrete, fully coordinated with requirements for required finish material.
2. Form exposed areas of columns, beams, ledges, balcony fascias to achieve true alignment and level soffit of edge beams and concrete edges. All such areas must be sharp, straight and true to line and level. Edge beams and concrete canopies and ledges must have adequate shoring to prevent any visible amount of sag and sufficient bracing to prevent any lateral movement during construction.

2.2 FORM MATERIALS

A. General: Plywood, fiberglass, metal, metal-framed plywood faced, or other acceptable panel-type materials.

1. Provide materials with sufficient strength to prevent warping.

B. Plywood: Of species and grade suitable for intended use, sound undamaged sheets with clean true edges, minimum 5/8" (16mm) thick, complying with U.S. Product Standard PS-1.

1. Other Acceptable Sheet Materials: 14 gauge (2.0mm) sheet steel or fibrous glass reinforced resin.

C. Lumber: Construction grade or better consistent with calculation requirements, without loose knots or other defects.

1. Use only where entire width can be covered with one board 11-1/4" (285mm) or less in width.

D. Forms for Cylindrical Columns and Supports: Metal, glass-fiber reinforced plastic, or paper or fiber tubes that will produce smooth surfaces without joint indications.

1. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.

E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to support weight of placed concrete without deformation.

F. Chamfer for Form Corners:

1. Types: Chamfer strips of wood, metal, PVC or rubber fabricated to produce smooth form lines and tight edge joints, 3/4" (20mm) size, maximum possible lengths.
2. Required for all exposed corners of beam, walls and column forms.

G. Form Ties:

1. Type: Factory-fabricated metal, adjustable length, designed to prevent form deflection and to prevent spalling concrete upon removal.
2. Ties used for architecturally exposed concrete shall be galvanized.
3. Ties shall not leave metal closer than 1-1/2" (40mm) to exposed surface.
4. When removed, ties shall not leave holes larger than 1" (25mm) diameter in concrete surface.
5. Removable Ties: Use type with tapered cones, 1" (25mm) outside diameter, for concrete walls which will remain exposed to view and scheduled for architectural finishes.
6. Snap-Off Ties: Use for concrete walls below grade and walls which will not remain exposed to view and are not scheduled for architectural finishes.
7. Wire Ties: Not acceptable.

H. Nails, Spikes, Lag Bolts, Thru-Bolts, Anchorages:

1. Type: Of size, strength and quality to meet the required quality of formwork.

I. Form Release Agent:

1. Type: Commercial formulation form release agent of non-emulsifiable type which will not bond with, stain, or adversely affect concrete surfaces. Form release agent shall not impair subsequent treatment of concrete surfaces requiring bond or adhesion, or impede the wetting of surfaces to be cured with water or curing compounds. Form release agent shall be compatible with subsequent architectural finish materials applied to concrete surfaces. Apply in compliance with manufacturers' instructions.
2. Form release agent shall meet, at a minimum, all federal and state requirements for volatile organic compounds (VOC's).
3. For Steel Forms: Non-staining rust-preventative type.

J. Reglets: Provide sheet metal reglets formed of same type and gauge as flashing metal, unless indicated otherwise on Drawings. Where resilient or elastomeric sheet flashing, or bituminous membranes are

terminated in reglets, provide reglets of not less than 26 gauge (0.55mm) galvanized sheet metal. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

K. Coordinate with materials as specified in Section 03 2000 Concrete Reinforcement and Embedded Assemblies.

PART 3 - EXECUTION

3.1 FORMWORK

A. General:

1. Inspect areas to receive formwork.
2. Construct forms to sizes, shapes, lines, and dimensions shown on Contract Documents, and to obtain accurate alignment, location, grades, level and plumb work in finished structures.
3. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins, and to maintain alignment.
4. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, drips, bevels, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in the Work.
5. Comply with shop drawings, ACI 301, 318, 347 and Contract Documents.
6. Maintain formwork and finished work construction tolerances complying with ACI 301 and 117.
7. Provide shore and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof.
8. Erect forms for easy removal without hammering or prying against concrete surfaces.
9. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
10. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only.
11. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
12. Chamfer exposed corners and edges as indicated on the architectural drawings, using wood, metal, PVC or rubber chamfer strips fabricated to produce smooth lines and tight edge joints.
13. Design, erect, support, brace and maintain formwork and shoring to support loads until such loads can be safely supported by the concrete structure.
14. Where specifically shown on the Contract Documents as monolithic, upturned beams, curbs and similar members in connection with slabs shall be formed so that they can be poured integrally with slabs.

B. Concrete Accessories and Embedded Items:

1. Install into forms concrete accessories, sleeves, inserts, anchor bolts, anchorage devices and other miscellaneous embedded items furnished by other trades or that are required for other work that is attached to or supported by cast-in-place concrete.
    a. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached.

2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated on drawings or required by other trades.
4. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces.
5. Coordinate with CONCRETE REINFORCEMENT AND EMBEDDED ASSEMBLIES Section in Specification 03 2000.
6. Install accessories and embedded items straight, level, plumb and secure in place to prevent displacement by concrete placement.

C. Temporary Openings:

1. Locate temporary openings in forms at inconspicuous locations.
2. For clean-outs and inspection before concrete placement, locate temporary openings where interior area of formwork would otherwise be inaccessible.
3. For cleaning and inspections, locate openings at bottom of forms to allow flushing water to drain.
4. Securely brace temporary openings and set tightly in forms to prevent loss of concrete.
5. Close temporary openings with tight fitting panels, flush with inside face of forms, neatly fitted so that joints will not be noticeable on exposed concrete surfaces.

D. Provisions for Other Trades: Coordinate and provide openings in concrete formwork to accommodate work of other trades.

1. Determine size and location of openings, recesses, chases, offsets, openings, depressions, and curbs from information provided by trades requiring such items.
2. Accurately place and securely support items built into forms.

E. Cleaning:

1. Normal Conditions:

    a. Thoroughly clean forms and adjacent surfaces to receive concrete.
    b. Remove chips, wood, sawdust, dirt, standing water or other debris just before placing concrete.
    c. Flush with water or use compressed air to remove remaining foreign matter.
    d. Verify that water and debris can drain from forms through clean-out ports.

2. During Cold Weather:

    a. Remove ice and snow from within forms.
    b. Do not use de-icing salts.
    c. Do not use water to clean out completed forms, unless formwork and concrete construction will proceed within heated enclosure.
    d. Use compressed air or other means to remove foreign matter.

F. Form Release Agents

1. Before placing reinforcing steel and miscellaneous embedded items, coat contact surfaces of forms with an approved non-residual, low VOC form release agent in accordance with manufacturer's published instructions.
2. Do not allow release agent to accumulate in forms or come into contact with reinforcement or concrete against which fresh concrete will be placed.

    a. Coat steel forms with nonstaining, rust-preventative material.

3. Remove form release agent and residue from reinforcement or surfaces not requiring form coating.

G. Before Placing Concrete:

1. Inspect and check completed formwork, shoring and bracing to ensure that work is in accordance with formwork requirements of this section and Contract Documents, and that supports, fastenings, wedges, ties, and parts are secure.

    a. Make necessary corrections or adjustment to formwork to meet tolerance requirements.

2. Retighten forms and bracing before concrete placement to prevent mortar leaks and maintain proper alignment.
3. Notify Testing Agency sufficiently in advance of placement of concrete to allow inspection of completed and cleaned forms.

H. During Concrete Placement:

1. Maintain a check on formwork to ensure that forms, shoring, ties and other parts of formwork have not been disturbed by concrete placement methods or equipment.
2. Use positive means of adjustment as required for formwork settlement during concrete placing operations.

I. Camber:

1. Provide camber in formwork as required for anticipated deflections due to weight and pressures of fresh concrete and construction loads.
2. Camber bottom forms where indicated on the drawings. Whenever forms are cambered, screeded levels for establishing top of concrete must be cambered to the same amount and to the same profiles such that scheduled depth of member is not reduced by lifting of forms. Check camber and adjust forms before initial set as required to maintain camber.

J. Surface Defects:

1. Install forms that will not impair the texture of the concrete and are compatible with the specified finish type.

K. Formwork Loads on Grade

L. Where loads from formwork bear on grade, provide suitable load-spreading devices for adequate support and to minimize settlement. In no event shall frozen ground or soft ground be utilized directly as the supporting medium.

M. Footings and Grade Beams:

1. Provide forms for footings and grade beams if soil or other conditions are such that earth trench forms are unsuitable.
2. When trench forms are used, provide an additional 1" (25mm) of concrete on each side of the minimum design profiles and dimensions indicated.

N. For slabs-on-grade, secure edge forms in such a manner as to not move under weight of construction loads, construction and finishing equipment, or workers.

3.2 REMOVING FORMS

A. Formwork not supporting the weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50°F (10°C) for 12 hours after placing concrete, provided concrete is sufficiently hard to avoid damage by form-removal operations, and provided curing and protection operations are maintained after removal of formwork.

B. Formwork supporting the weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed until concrete has attained at least [75%] of design compressive strength.**[If stripping occurs before [3] days, 100% strength must be achieved.]** For multistory buildings, enough shoring should be provided for a sufficient number of floors to be built to properly support the construction loading from reshoring.

C. Determination of early age compressive strength of concrete at time of formwork removal shall be made by compression tests of field-cured cylinders or by the maturity method in accordance with ASTM C1074. If the maturity method is used, submit sufficient data using project materials to demonstrate correlation of measurements on the structure with the compressive strength of laboratory-cured molded cylinders.

D. Remove formwork progressively using methods to prevent shock loads or unbalanced loads from being imposed on structure. Comply with ACI 347.

E. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.

F. Whenever formwork is removed during the curing period, the exposed concrete shall be cured per requirements of Section 03 3000.

G. All wood formwork, including that used in void spaces, pockets and other similar places shall be removed.

H. Form tie holes shall be filled as per approved samples submitted to the Design Professionals.

I. The Contractor shall assume responsibility for all damage due to removal of the forms.

3.3 RE-USING FORMS

A. Before forms can be re-used, surfaces that will be in contact with freshly poured concrete must be thoroughly cleaned, damaged areas repaired, and projecting nails withdrawn.

1. Split, frayed, delaminated or otherwise damaged form-facing material will not be acceptable.
2. Apply new form release agent on re-used forms.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets.

C. Forms for exposed concrete may be reused only if the surfaces have not absorbed moisture and have not splintered, warped, discolored, stained, rusted or peeled, subject to acceptance by the Design Professionals. The Design Professionals reserve the right to require the Contractor to remove and reconstruct such formwork as will produce subsequent areas that are acceptable. Do not use "patched" forms for exposed concrete surfaces, unless approved by the Design Professionals.

3.4 CORRECTIVE MEASURES

A. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in Part 3 – CORRECTIVE MEASURES section of Specification 03 3000.

END OF SECTION

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SECTION 03 2000
CONCRETE REINFORCEMENT AND EMBEDDED ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to requirements of Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections.

1.2 SCOPE

Provide all labor, materials, equipment, services and transportation for reinforcing steel, accessories, embedments and miscellaneous anchorage accessories, joint fillers, and waterstops for cast-in-place concrete work as shown on Drawings, as specified herein, and as required by the job conditions.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 4500
Concrete Formwork	Section 03 1000
Cast-In-Place Concrete	Section 03 3000
Thermal and Moisture Protection	Division 7

1.4 CODES AND STANDARDS

A. Building Code: Concrete work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 –Specifications for Structural Concrete.
3. ACI 315 – Details and Detailing of Concrete Reinforcement.
4. ACI 318 – Building Code Requirements for Structural Concrete and Commentary.
5. ACI 355.2 – Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary
6. ACI 355.4 – Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary
7. American Society for Testing and Materials "ASTM Standards in Building Codes", various standards as referenced herein.
8. AWS D1.1 – Structural Welding Code-Steel.
9. AWS D1.4 – Structural Welding Code-Reinforcing Steel.
10. CRD C 572 – Specification for Polyvinylchloride Waterstops.
11. Concrete Reinforcing Steel Institute ”Manual of Standard Practice”
12. ASTM D3963 Fabrication and Jobsite Handling of epoxy Coated Steel Reinforcing Bars.

C. Definitions:

1. See Section 03 3000.

1.5 CONTRACTOR QUALIFICATIONS

A. The work of this section shall be performed by a fabricator specializing in the type of reinforcement fabrication required for this Project, with a minimum of 10 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

1. Welders shall be qualified in accordance with applicable AWS Code within 12 months before starting the work.
   a. Make qualification records available to the Design Professionals upon request.

B. Manufacturers shall specialize in manufacturing the types of concrete accessories required for cast-in-place concrete work, with a minimum of 10 years of documented successful experience and shall have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility and warranty for each type of accessory.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested. Reproduction of Contract Drawings as shop drawings is not permitted.

1. Submittal Schedule
2. Shop Drawings
3. Product Data
4. Mill Reports
5. Reinforcement Strain Test
6. Hazardous Materials Notification

1. **Submittal Schedule**: See Section 03 3000.
2. **Shop Drawings**: Submit for action shop drawings that shall clearly indicate, but not be limited to:
   a) All details, dimensions and information required for fabrication and placement of concrete reinforcement in accordance with Contract Documents, prepared in accordance with ACI 315 recommendations.
   b) Elevations, plans, sections, and dimensions of concrete work with required reinforcement clearances.
   c) Ledges, brackets, openings, sleeves, anchor rods, embedments, prefabricated bent-in dowel keyway systems, electrical conduit and items of other trades including interference with reinforcing materials.
   d) Sizes, grade designations, spacing, locations, and quantities of wire fabric, reinforcement bars, temperature and shrinkage reinforcement dowels.
      i. Do not use dimensions scaled from Contract Drawings to determine bar lengths.
      ii. Hooks and bends not specifically dimensioned shall be detailed per ACI 318.

e) Bending and cutting schedules, assembly diagrams, splicing and connection requirements, details, and laps.
f) Each type of supporting and spacing devices, including miscellaneous accessories.
g) Construction joint type, details, and locations. Contractor shall coordinate construction joint type, details, and locations with concrete pour schedule. Submittal shall include details for each type of construction joint in accordance with Contract Documents.
h) Locations and dimensions of openings in structural members including floor slab, shear walls, columns and beams. See SUBMITTALS Section of Specification 03 3000.
i) Concrete accessories and embedded items. See SUBMITTALS Section of Specification 03 3000.

3. **Product Data**: Submit for action for each type of product identified in Part 2. Product Data shall be clearly marked to indicate all technical information which specifies full compliance with this section and Contract Documents, including published installation instructions and I.C.C reports, where applicable, for products of each manufacturer specified in this section.
4. **Mill Reports**: Submit for record.
5. **Reinforcement Strain Test**: For Grade 75 reinforcement, submit for record certification that steel has a yield strength of no less than 75 ksi as measured by both ASTM A615 and ACI 318 Section 3.5.3.2 procedures.
6. **Hazardous Materials Notification**: Submit for record. In the event no product or material is available that does not contain hazardous materials as determined by the Owner, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

B. Submittal Process: See Section 03 3000.

C. SER Submittal Review: See Section 03 3000.

D. Substitution Request: See Section 03 3000.

E. Request for Information (RFI): See Section 03 3000.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions and Division 1, including the following:

1. Deliver reinforcing steel to Project site bundled, tagged and marked.

(a) Use weatherproof tags indicating bar sizes, lengths and other information corresponding to markings shown on placement diagrams.

2. Deliver welded wire fabric in sheets. Do not deliver in rolls.
3. During construction period, properly store reinforcing steel and accessories to assure uniformity throughout the Project.
4. Deliver and store welding electrodes in accordance with AWS D1.4.
5. Immediately remove from site materials not complying with Contract Documents or determined to be damaged.
6. Store reinforcing steel above ground so that it remains clean.

a) Maintain steel surfaces free from materials and coatings that might impair bond.
b) Keep covered.
c) Protect against corrosion or deterioration of any kind.

1.8 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. See Section 01 4500.

1.9 QUALITY CONTROL BY CONTRACTOR

A. See Section 03 3000.

1.10 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. See Section 03 3000.

1.11 PERMITS AND WARRANTY

A. Permits: See Section 03 3000.

B. Warranty: See Section 03 3000. Failures include but are not limited to the following:

1. Bars with kinks or bends not indicated on Drawings or on approved shop drawings.
2. Bars damaged due to bending, straightening or cutting.
3. Bars heated for bending.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel:

1. Type: Deformed billet steel bars, ASTM A 615, Grade 60 or 75 as indicated on Drawings.
2. Size: As indicated on structural Drawings.
3. Where indicated on Drawings, reinforcing steel shall be hot-dipped galvanized after fabrication in accordance with ASTM A 767, Class II, with galvanizing material protected from embrittlement during galvanizing process in accordance with ASTM A 143.

   (a) Galvanized finish shall meet the bend and shear test requirements of ASTM A 615.

4. Epoxy-Coated: ASTM A 775 where indicated on Drawings.

B. Welded Wire Reinforcement:

1. Type: steel wire, deformed, ASTM A1064.

2. Size: As indicated on structural Drawings.
3. Where indicated on Drawings, welded wire reinforcement shall be hot-dipped galvanized after fabrication in accordance with ASTM A 1060, , with galvanizing material protected from embrittlement during galvanizing process in accordance with ASTM A 143.

   (a) Galvanized finish shall meet the bend and shear test requirements of ASTM A 615.

4. Plain Steel Welded Wire Reinforcement: ASTM A 1064.
5. Deformed Steel Welded Wire Reinforcement: ASTM A 1064.
6. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884, Class A.

C. Reinforcement Coating Repair Materials:

1. Apply repair coating in accordance with the manufacturer's written procedures.
2. Galvanized Repair Coating: Zinc-based solder, paint containing zinc dust or sprayed zinc complying with ASTM A780.
3. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying withD3963/D3963M referencing Annex A2 of ASTM A775/A775M.
   a. The maximum amount of repaired damaged areas shall not exceed 2% of the surface area in each linear foot of each bar. If more than 2% of the surface area in each linear foot of bar is damaged, bar shall be replaced.

2.2 ACCESSORIES

A. Tie Wire:

1. Type: Minimum 16 gauge (1.5mm) annealed steel wire, ASTM A 510 and ASTM A 853.
2. Wire Bar Type: Comply with CRSI.

B. Headed Bars:

1. For bar sizes #11 (ø36) or smaller where specifically detailed on Drawings, mechanical bar terminators shall be used.
2. Headed bars shall meet the requirements of ASTM A970, Class HA.
3. Acceptable Products:

   a. Headed Bars by Dextra
   b. Lenton Terminator by Erico
   c. Grip-Twist Doughnut by Bar-Splice
   d. BPI ButtonHead by BarSplice
   e. Zap T-Lok by BarSplice
   f. Taper-Lock End Anchor Disc by Dayton Superior
   g. 100, 550 and 670 Series by Headed Reinforcement Corp

C. Slip Dowel Bar/Plate Systems for Slab on Grade Joints

1. Acceptable Products:

a. Speed Dowel or Speed Plate by Sika Corporation
b. QuicDowel or QuicPlate by BoMetals, Inc.
c. Diamond Dowel System by PNA Construction Technologies

D. Supports for Reinforcement:

1. Types: Bolsters, chairs, spacers, clips, chair bars, and other devices for properly placing, spacing, supporting, and fastening the reinforcement, plastic, plastic protected steel, or epoxy coated to match supported reinforcement.
2. For Contact with Forms: Use types with not less than 3/32" (2.5mm) of plastic between metal and concrete surface.
    a. Plastic tips shall extend not less than ½" (12mm) on metal legs.
3. Individual and continuous slab bolsters and chairs shall be of type to suit various conditions encountered and must be capable of supporting 300 pound (1.5kN) load without damage or permanent distortion.
4. Unless otherwise indicated on Drawings, bottom reinforcing bars in footings shall be supported by precast concrete bricks or individual high chairs with welded sand plates on bottom.
5. For Slabs on Grade: Use supports with sand plates or horizontal runners where base material will not support chair legs.

E. Deformed Bar Anchors:

1. Type: Automatic end welded, ASTM A 496 quality.
2. Size and Grade: As indicated on structural Drawings by Nelson Stud Welding.

F. Anchor rods and dowels:

1. Types and Sizes: Provide sizes and types of anchor rods and dowels as indicated on the Drawings. Each type of anchor shall be manufactured of structural quality steel, designed for cast-in-place concrete applications and be of sizes as indicated on Drawings, complete with washers, nuts, plates and miscellaneous accessories required to meet Contract Document requirements.
2. Adhesive Anchors for anchor rods and dowels in existing concrete: See Anchorage Accessories.

G. Prefabricated Bent-In Dowel Keyway Systems and Dowel Bar Replacements:

1. Type, Size and Grade as indicated on Drawings.
2. Dowels shall be installed in accordance with manufacturer's requirements
3. Acceptable Products:
    a. Lenton Form Savers by Erico
    b. Keyway Splice Box by Meadow Burke
    c. Metalstrip by Dayton Superior
    d. DBDI Splice System by Dayton Superior
    e. D50 DBR Coupler System by Dayton Superior
    f. BPI Barsplicer by BarSplice
    g. 300 Series by Headed Reinforcement Corp

2.3 ANCHORAGE ACCESSORIES

A. General: Miscellaneous anchorage accessories for anchoring structural, architectural, electrical, and mechanical items to poured concrete shall include but not be limited to the following:

1. Concrete Anchors: Headed or bent studs ASTM A 108/Grade 1015 through 1020, minimum yield strength of 50,000 psi (345MPa), minimum tensile strength of 60,000 psi (415MPa).
2. Anchor Rods: ASTM F1554, Grade as noted on Drawings.
3. Shallow Embedment Internally Threaded Inserts with ¾" maximum embedment.
    a. Acceptable Products:
        i. Mini Undercut + by DeWalt (for post-tensioned slabs and precast hollow core slabs)
        ii. HDI-P TZ by Hilti (for post-tensioned slabs)
4. Adhesive Anchors:
    a. Basis of Design: See General Notes
    b. Substitution Request: As anchor capacities vary by manufacturer, the following anchors will be considered as a Substitution Request. Refer to project specifications for Substitution Request procedure
        i. HIT-RE 500-V3 by Hilti, Inc.
        ii. Epcon C6+ by ITW Red Head
        iii. Epcon G5 by ITW Red Head
        iv. Pure 110+ by DeWalt
        v. SET-3G by Simpson Strong-Tie Co.
    c. The adhesive anchor system used for post-installed anchorage to concrete shall conform to the requirements of ACI 355.4 and commentary and shall possess a current ICC- ES report demonstrating compliance with ACI 318.
5. Expansion Anchors:
    a. Basis of Design: See General Notes
    b. Substitution Request: As anchor capacities vary by manufacturer, the following anchors will be considered as a Substitution Request. Refer to project specifications for Substitution Request procedure.
        i. Kwik Bolt 1 (KB1) by Hilti, Inc.
        ii. Power Stud+ SD1 or SD2 by DeWalt
        iii. Power Stud + SD6 (SS) by DeWalt
        iv. Trubolt by ITW CCNA
        v. Strong-Bolt 2 by Simpson Strong-Tie Co.
    c. The expansion anchors used for post-installed anchorage to concrete shall conform to the requirements of ACI 355.2 and commentary and shall possess a current ICC- ES or IAPMO UES report demonstrating compliance with ACI 318.
6. Threaded Screw Anchors:
    a. Basis of Design: See General Notes

b. Substitution Request: As anchor capacities vary by manufacturer, the following anchors will be considered as a Substitution Request. Refer to project specifications for Substitution Request procedure.

i. Screw-Bolt + by DeWalt
ii. Tapcon + by ITW Red Head
iii. Titan HD by Simpson Strong-Tie Co., Pleasanton, CA

7. Inserts and Coil Rods: Yield strength 65,000 psi (450MPa), ASTM B 633, manufactured by Acrow-Richmond Limited or Dayton Superior
8. Welding Electrodes: AWS 5.5, Series E70.
9. Welded Deformed Bar Anchors: Welded by full-fusion process, as furnished by TRW Nelson Stud Welding Division or equivalent.

B. Dovetail Anchor Slots:

1. Type: Formed 22 gauge (0.85mm) galvanized steel
2. Acceptable Manufacturers:

i. Heckmann Building Products
ii. Hohmann and Barnard,
iii. BoMetals, Inc.

3. Location of Use: Continuous installation of anchor slots, full height of masonry walls, where masonry walls abut poured concrete walls.
4. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.
5. Finish: Hot-dip galvanized or zinc-plated steel.
6. Stainless steel anchors are acceptable.

2.4 JOINT FILLERS

A. Permanent Compressible Joint Filler:

1. Acceptable Product: W. R. Meadows: “Ceramar” closed-cell expansion joint filler, ultraviolet stable, minimal moisture absorption, non-impregnated, nonstaining and nonbleeding, inert and compatible with cold-applied sealants.
2. Location of Use: Slabs and curbs as indicated on Drawings or required.
3. Thickness: As indicated on Drawings or required.

B. Temporary Compressible Joint Filler:

1. Type: White molded polystyrene beadboard.
2. Location of Use:

a. In slabs, curbs, and walls which must be removed prior to joint sealant installation.
b. Vertically to isolate walls from columns or other walls.

C. Semi Rigid Joint Filler:

1. Acceptable Product: Euclid Chemical Company “Euco 700” or “Euco QWIKjoint 200”
2. Acceptable Product: Sika Corporation “Sikadur 51 SL”
3. Acceptable Product: W.R. Meadows Sealtight “Rezi-Weld Flex”

D. Noncompressible Joint Filler:

1. Acceptable Product: Dow Chemical's "STYROFOAM 40" rigid closed-cell extruded polystyrene board, square edges, 40 psi (275kPa) compressive strength, ASTM C 578, Type IV.
2. Thickness: As indicated on Drawings.
3. Location of Use: As indicated on Drawings or required.

E. Asphalt-Impregnated Joint Filler:

1. Acceptable Product: W.R. Meadows Asphalt Expansion Joint Filler, preformed, ASTM D 994.
2. Thickness: ½” (12mm) maximum, as indicated on Drawings or required.
3. Location of Use: Sidewalks at foundation walls and as indicated on Drawings or required.

F. Asphalt-impregnated fiberboard expansion joint filler for interior work:

1. Type: ASTM D1751.

G. Self-expanding cork board expansion joint filler for exterior work:

1. Type: ASTM D1752.

H. Construction Joints:

1. Type: Tongue and groove type profile of galvanized steel, with knock-out holes at 6" (150mm) on center to receive dowelling, complete with anchorage.

2.5 WATERSTOPS

A. Preformed Swellable Waterproofing Strips especially formulated for concrete cold joints at footings, walls, or slabs.

1. Acceptable Products:

a. Volclay Waterstop RX by CETCO Building Materials Group
b. Adcor ES by GCP Applied Technologies
c. Hydrotite by Sika

2. Size: 3/4" (20mm) by 3/8" (10mm) strips minimum, 25 ft. (7.5m) long, and weighing at least 0.165 lbs/ft (0.245kg/m).
3. Location of Use: Concrete cold joints at footings, walls and slab joints.
4. Comply with manufacturer product application and installation instructions.

B. Polyvinyl Chloride Waterstops:

1. Type: PVC Waterstops for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections and directional changes. U.S. Corp of Engineers Specification CRD C 572.
2. Acceptable Products:

    a. PVC Waterstops" by BoMetals
    b. Greenstreak by Sika
    c. Sealtight PVC Waterstops by W.R. Meadows

PART 3 - EXECUTION

3.1 FABRICATION

A. Reinforcing Steel Fabrication:

1. Fabricate in accordance with approved shop Drawings, ACI 315 and Contract Documents.
2. Heating of Reinforcement: Will be permitted only with specific prior approval of the SER.
3. Welding: Comply with ANSI/AWS D1.4; use E9018 electrodes or approved electrodes.
4. Tolerances: Comply with ACI 117.
5. Unacceptable Materials: Reinforcement with any of following defects will not be permitted in Work.

    a) Bar lengths, depths, and bends exceeding ACI fabrication tolerances.
    b) Bends or kinks not indicated on Drawings or final shop drawings.
    c) Bars with reduced cross-section due to excessive rusting or other cause.

B. Welded Wire Reinforcement:

1. Type: As fabricated in accordance with CRSI, unless otherwise noted.

C. Templates:

1. Required for all footing and column dowels, and where required for proper alignment of reinforcing.

D. Assemblies:

1. Fabricate and assemble structural steel items in shop in conformance with AISC and AWS D1.1. Shearing, flame cutting, and chipping shall be done carefully and accurately. Cut, drill, or punch holes at right angles to the surface of the metal. Do not make or enlarge holes by burning. Holes shall be clean-cut without torn or ragged edges.
2. Welding of deformed bar anchors and headed stud anchors shall be installed by full-fusion process equivalent to TRW Nelson Stud Welding Division or KSM Welding Services Division, Omark Industries or Tru-Weld Stud Welding, Medina, OH.
3. Welding of reinforcement shall be done in accordance with AWS requirements. Welding shall be performed subject to the observance and testing by Testing Agency.
4. Galvanizing where required, shall be applied after fabrication and prior to casting concrete.
5. Welding of crossing bars (tack welding) for assembly of reinforcement is not permitted without use of weldable reinforcement and express written consent of SER.

3.2 INSTALLATION OF REINFORCEMENT

A. General:

1. Perform the work of this section in accordance with approved shop drawings, ACI 318 and CRSI recommended practice for “Placing Reinforcing Bars”, for details and methods of reinforcement placement and supports, and as specified.
2. Before placing reinforcement steel, inspect forms for proper fitting and compliance with allowable tolerances.
3. Reinforcement shall be free of form coatings, sealers, powdered and scaled rust, loose mill scale, earth, ice, and other materials which will reduce or destroy bond with concrete.
4. Do not place concrete until the completed reinforcement steel work has been observed and accepted by Owner’s Testing Laboratory.
5. Reinforcement steel is not permitted to be “floated into position”.
6. Bend bars cold.
    a. Do not heat or flame cut bars.
    b. No field bending of bars partially embedded in concrete is permitted, unless specifically approved by the SER and tested by Testing Agency for cracks.
7. Weld only as indicated.
    a. Perform welding per ANSI/AWS D12.1 and/or ANSI/AWS D1.4.
    b. See structural Drawings for additional requirements.
8. Tag reinforcement steel for easy identification.

B. Placement of Reinforcement Bars:

1. Comply with approved shop drawings, ACI 318 and Contract Documents.
2. Accurately position, support and secure reinforcement in a manner to prevent displacement before and during placement of concrete.
    a. Place reinforcement bars within tolerances specified in ACI 117.
    b. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, hangers and other accessories for fastening reinforcing bars and welded wire reinforcement in place.
3. If bars are displaced beyond specified tolerance when relocating the bars to avoid interference with other reinforcement or embedded items, immediately notify the Design Professionals for approval prior to concrete placement.
4. Avoid cutting or puncturing vapor retarder during reinforcement placement.
    a. Repair damages before placing concrete.
5. Concrete Coverage: Maintain concrete cover around reinforcement as indicated on Drawings.
6. Bar Supports: Use type specified in this section.

7. Tie Wires: After cutting, turn tie wires to the inside of section and bend so that concrete placement will not force ends to be exposed at face of concrete.

C. Placement of Wire Reinforcement:

1. Install in lengths as long as practicable.
2. Support in position adequately to prevent bending of reinforcement between supports before and during placement of concrete.
3. Overlap the wire reinforcement 6" (150mm) or one panel width + 2" (50mm), whichever is larger.

    a. Securely tie together with wire.

4. Offset laps of adjoining widths to prevent continuous laps in either direction.
5. Locate wire fabric in the top third of slabs, unless noted otherwise on structural Drawings.

D. At Construction Joints:

1. Reinforcement bars and wire reinforcement shall be continuous through construction joints, unless otherwise indicated on Drawings. See Drawings for scheduled lap splices.

E. At Expansion Joints:

1. Reinforcing bars and wire fabric shall NOT be continuous through expansion joints, unless otherwise indicated on Drawings.

F. Splicing:

1. Unless otherwise indicated on Drawings provide lap splices for bar sizes #11 (ø36) and smaller by lapping ends, placing bars in contact, and tying tightly with wire in accordance with requirements of ACI 318 for lap lengths indicated on Drawings.
2. At all #14 (ø43) and #18 (ø57) bars and where mechanical splices are specifically indicated on Drawings, comply with requirements specified in this Specification section under "Mechanical Splicing Systems".
3. Do not splice reinforcement except as indicated on structural Drawings.
4. Tension couplers may be used and installed per manufacturer's specifications where indicated on Drawings or as approved by Engineer.

G. Dowels in Existing Concrete:

1. Install dowels and dowel adhesive in accordance with manufacturer's recommendations.
2. Minimum embedment length shall be 12 bar diameters, unless noted otherwise.

3.3 INSTALLATION OF POST-INSTALLED ADHESIVE ANCHORS

A. General:

1. Post-installed adhesive anchors shall be installed in accordance with the Manufacturer's Printed Installation Instructions (MPII).

2. The adhesive anchors shall be supplied as an entire system. The contractor shall provide all equipment required to install the adhesive anchor in accordance with the MPII.
3. Anchors shall be installed in holes drilled with a rotary impact hammer drill with carbide bit. Contractor shall obtain prior written approval from SER before using rock drilling or core drilling installation methods.
4. Anchor holes shall be thoroughly cleaned and dry prior to adhesive injection, in accordance with the MPII. Anchors to be installed in the adhesive shall be clean, oil-free, and free of loose rust, paint, or other coatings.
5. Concrete shall have a minimum compressive strength of 2500 psi (17MPa).
6. Concrete at time of adhesive anchor installation shall have a minimum of 21 days.
7. Concrete temperature at the time of adhesive anchor installation shall be at least equal to manufacture's requirements, or 50° F (10°C) if no requirement exists.
8. Support the anchor and protect it from disturbance or loading for the full cure time stated by the manufacturer at that base material temperature.
9. Unless specified otherwise in the contract documents, anchors shall be installed perpendicular to the concrete surface. Anchors displaced or disturbed prior to the adhesive cure time shall be considered damaged and reported to the SER (see Observations and Corrections section of 03 3000).
10. Locate, by non-destructive means, and avoid all existing reinforcement prior to installation of anchors. If existing reinforcement layout prohibits the installation of anchors as indicated in the drawings the contractor shall immediately notify the Design Professionals.
11. Reinforcement bars or all-threaded bars shall not be bent after being adhesively embedded in hardened, sound concrete, unless written approval is given by the SER.
12. All personnel installing anchors shall be trained by the manufacturer on proper installation techniques. Submit for record certificate from training documentation from the manufacturer for each installer on this Project
13. Installation of adhesive anchors horizontally or upwardly inclined and anchors that are designated with a (CERT) after the anchor call-out, shall be performed by personnel certified by the ACI/CRSI Adhesive Anchor Installer Certification program. Submit for record certificate from ACI-CRSI Adhesive Anchor Installation Certification Program for each certified installer on this Project.

3.4 INSTALLATION OF ACCESSORIES AND EMBEDDED ITEMS

A. Install concrete accessories in accordance with manufacturer's published instructions and Contract Documents.

1. Set and secure embedments, including embedded plates, bearing plates, and anchor rods, per approved setting drawings and in such a manner to prevent movement during placement of concrete and to allow removal of formwork without damage.
2. Tolerances: Anchor rod and other embedded items placement tolerances shall comply with AISC 303, “Code of Standard Practice”, Section 7.5.
3. Inspect locations to receive concrete accessories.
4. Immediately notify the Design Professionals in writing of conditions that will adversely affect the Work or fail to meet Contract Document requirements.
5. Do not place concrete until reinforcement, accessories and other built-in items have been inspected and accepted by Testing Agency.

B. Construction and Contraction (Control) Joints:

1. Construction and contraction (control) joints indicated on Drawings are mandatory and must not be omitted.

    a. Provide construction joints in accordance with ACI 318.
    b. Roughen surface at construction joints as indicated on the drawings.
    c. Where specifically indicated on drawings, provide 1-1/2" (40mm) deep key type construction joints at end of each placement for slabs, beams, walls and footings.

        i. Bevel forms for easy removal.

2. Provide waterstops in construction joints as indicated on the Contract Documents in sizes to suit joint.
3. Install waterstops to form continuous diaphragm in each joint.
4. Support and protect exposed waterstops during progress of Work.
5. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

C. Coordinate the installation of pipes, bolts, hangers, anchors, flashing and other embedded items with the work of other trades.

3.5 CORRECTIVE MEASURES

A. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in Part 3 – CORRECTIVE MEASURES section of Specification 03 3000.

END OF SECTION

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to requirements of Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections.

1.2 SCOPE

Provide all labor, materials, equipment, services and transportation required to complete all concrete work as shown on Drawings, as specified herein, and as required by the job conditions. This Specification is not intended to address the particular requirements of Architectural Concrete.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 4500
Concrete Formwork	Section 03 1000
Concrete Reinforcement and Embedded Assemblies	Section 03 2000
Thermal and Moisture Protection	Division 7

1.4 CODES AND STANDARDS

A. Building Code: Concrete work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials except as modified by more stringent requirements in the Project Specifications and/or Drawings.
2. ACI 237 – Self Consolidating Concrete.
3. ACI 301 – Specifications for Structural Concrete.
4. ACI 318 – Building Code Requirements for Structural Concrete and Commentary.
5. American Concrete Institute “Manual of Concrete Practice”, various committee reports as referenced herein.
6. American Society for Testing and Materials "ASTM Standards in Building Codes", various standards as referenced herein.
7. AASHTO T318 – Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.

C. Definitions:

1. The term “Contract Documents” in this Specification is defined as the design Drawings and the specifications.
2. The term “SER” in this Specification is defined as the Structural Engineer of Record for the structure in its final condition.
3. The term “Design Professionals” in this Specification is defined as the Owner’s Architect and SER.
4. The term “Contractor” in this Specification is defined to include any of the following: General Contractor and their sub-contractors, Construction Manager, Concrete Contractor and their sub-contractors.
5. The term “Testing Agency” in this Specification is defined as an independent testing and inspection service engaged by the Owner for quality assurance testing and inspection of structural construction in accordance with applicable building code provisions and any additional activities listed in the Contract Documents.
6. The terms “for record” and “submit for record” in this Specification are defined as Contractor submittals that do not require a response from the Design Professionals.
7. The term “Working Days” in this Specification is defined as Monday through Friday, excluding federal or state holidays.
8. The term “Delegated Design” in this Specification is defined as a scope of work that meets performance and design criteria established in the Contract Documents and is to be completed by the Contractor’s licensed engineer.

1.5 CONTRACTOR QUALIFICATIONS

A. The work of this section shall be performed by a company specializing in the type of concrete work required for this Project, with a minimum of 10 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

B. Contractor’s testing agency services: Required as specified in Division 1, and herein.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested. Reproduction of Contract Drawings for shop drawings is not permitted.

1. Submittal Schedule
2. Mix Designs
3. Concrete Travel Times to the Project Site
4. Hot and Cold Weather Procedures
5. Product Data
6. Concrete Joint Locations
7. Comprehensive Layout Drawings
8. Preconstruction Survey
9. Survey of Flat Plate or Flat Slab Concrete Floors during construction
10. FF/FL Testing
11. Structural Repairs
12. Patching Defective Concrete Finishes
13. Conduit and Pipes Embedded in Concrete

14. Hazardous Materials Notification

15. **Submittal Schedule**: The contractor shall submit for action a schedule at least twenty (20) working days prior to commencing submittals.
    a. This schedule shall include a list, in order of date to be submitted, of all drawings and other required submittal items scheduled to be submitted. The schedule shall list the proposed submittals for each week, as well as their formats. Once shop drawing submissions have commenced any modification or addition to this schedule must be submitted for action at least twenty (20) working days before the modification or addition is proposed to take place.
    b. If at any time the total number of shop drawings received in any one week period exceeds the amount in the approved schedule by more than 10% for that week, the Design Professionals have the right to add two days to the average turnaround time for each 20% increment in excess of the scheduled quantity for that week's submissions. For example if the weekly total exceeds the schedule by 10% to 20%, two days may be added; if it is exceeded by 21% to 40%, four days may be added. The return dates for subsequent submittals may be extended based on the additional review time stated above.
    c. For the purposes of developing a schedule, assume the following review rate, Shop drawings – 10 full size sheets per week.

16. **Mix Designs**: Submit for action concrete mix designs for each type and strength of concrete required for this Project at least thirty (30) days before placing concrete.
    a. Mix designs shall be prepared or reviewed by an approved independent testing agency retained by the Contractor in accordance with requirements of ACI 301 and ACI 318 and shall be coordinated with design requirements and Contract Documents.
    b. Before submitting to Testing Agency, submit complete mix design data for each separate mix to be used on the Project in a single submittal.
    c. Provide a completed "Concrete Mix Design Submittal Form" (attached to the end of this Specification Section) for each proposed concrete mix.
    d. Mix materials shall be from the same production facility that will be used for this Project.
    e. Mix Design data shall include but not be limited to the following:
        i. Locations on the Project where each mix design is to be used corresponding to Structural General Notes on the Drawings.
        ii. Design Compressive Strength: As indicated on the Drawings.
        iii. Proportions: ACI 301 and ACI 318.
        iv. Gradation and quality of each type of ingredient including fresh (wet) unit weight, aggregates sieve analysis.
        v. Water/cementitious material ratio.
        vi. Evaluation and classification fly ash in accordance with ASTM D 5759.
        vii. Report of chemical analysis of fly ash in accordance with ASTM C 618.
        viii. Classification of slag cement in accordance with ASTM C 989.
        ix. Slump: ASTM C 143.
        x. Certification and test results of the total water soluble chloride ion content of the design mix - AASHTO T260 or ASTM C 1218 at age between 28 and 42 days.
        xi. Air content of freshly mixed concrete by the pressure method, ASTM C 231, or the volumetric method, ASTM C 173.
        xii. Density of Concrete: ASTM C 138.
        xiii. Design strength at 28, 56 or 90 days, as indicated on Contract Documents: ASTM C 39.
            a) Document strength based on basis of previous field experience or trial mixtures per ACI 301. Proportioning by water-cement ratio alone, with no test results per the trial mixtures procedure is not permitted.

b) Submit strength test records, mix design materials, conditions, and proportions for concrete used for record of tests, standard deviation calculation, and determination of required average compressive strength. Test records to support proposed mixtures shall be no more than 24 months old and use current cement aggregate sources. Test records to establish standard deviation may be older if necessary to have the required number of samples.

c) If early concrete strengths are required, Contractor shall submit trial mixture results as required.

xiv. Manufacturer's product data for each type of admixture.

xv. Manufacturer's certification that all admixtures used are compatible with each other.

xvi. All information indicating compliance with Contract Documents including method of placement and method of curing.

xvii. Normalweight Concrete: Density per ASTM C 138. Design the mix to produce the strength, modulus of elasticity and density as indicated on the Contract Documents.

xviii. Lightweight Concrete: Density per ASTM C 138. Design the mix to produce the strength, modulus of elasticity and density as indicated on the Contract Documents.

xix. Certification from a qualified testing agency indicating absence of potential for deleterious expansion of concrete due to alkali reactivity of the aggregate as determined by testing per ASTM C1260 in accordance with ASTM C 33. If potential for deleterious expansion exists, expansion reduction and mitigation measures per the guidelines of ASTM C1778 or US Army COE CRD-C662 shall be submitted for review by the SER.

17. Concrete Travel Times to the Project Site: Submit for record.

18. Hot and Cold Weather Procedures: Submit for record written procedures for placement of concrete in hot and cold weather conditions. Hot and Cold weather are as defined in the Concrete Placement section of this Specification.

19. Product Data: Submit for action product data clearly marked to indicate locations to be used and all technical information which specifies full compliance with this section and Contract Documents, including published application instructions, product characteristics, compatibility, and limitations for each of the following:
    a) Bonding agents.
    b) Curing compound and liquid sealer densifier. Submit for record to Design Professionals a written statement guaranteeing that the compound will not leave discoloration on concrete to be left exposed, or affect the bond for paint or other applied finishes. Include provision in written statement that in the event of failure of applied finishes to bond to membrane cured concrete, to remove the curing compound and leave suitable surfaces for bonding such finishes.
    c) Absorptive covers and moisture retaining covers.
    d) Vapor Retarder: See Division 7, Thermal and Moisture Protection.
    e) Self-leveling concrete topping.
    f) Grout: Submittal of grout by manufacturers not listed herein must be accompanied by independent certification of ASTM C 1107 compliance without modification of standard methods.
    g) Other products proposed by Contractor.

20. **Concrete Joint Locations**: Submit for action plans indicating locations and details of construction joints, contraction joints, waterstops, sleeves, embedments, etc. that interact with the joints. Contractor to coordinate joint location with reinforcement shop drawings. Reinforcement shop drawings shall indicate additional reinforcement bars where required at construction joints.

Joint locations for concrete slabs to receive a terrazzo or similar finish subject to reflective cracking must be coordinated with layout of finish drawings.

21. **Comprehensive Layout Drawings:** Submit for action comprehensive layout drawings (a single drawing per area/element):
    a. Drawings shall show openings in structural members, including floor slab, shear walls, columns and beams.
    b. Drawings shall consolidate the work of all trades and shall be coordinated by the Contractor.
    c. Drawings shall show concrete accessories and embedded items, including fabrication details of items to be placed (exclusive of reinforcement).
    d. Submit with or prior to reinforcement and formwork submittals for same element/area.

22. **Preconstruction Survey**: Submit for record. Where interface with existing construction occurs, before related shop drawings are prepared survey the existing construction and submit the survey prepared by a professional surveyor employed by the Contractor to the Design Professionals.
23. **Survey of Flat Plate or Flat Slab Concrete Floors during construction**: Submit for record. Survey requirements are described on Drawings. Based on survey results, SER may propose adjustments to formwork and camber.
24. **FF/FL Testing:** Submit for record. Testing Agency to test and report flatness (F_F), levelness (F_L) prior to shoring removal. Do not test slabs for levelness (F_L) that include camber, inclined surfaces or planned changes in floor surface slope. Perform F_F/F_L testing in accordance with ASTM E 1155 requirements.
25. **Structural Repairs**: Submit for action procedures, intended locations, and product information. Alterations to design shall be sealed and signed by a **[Professional/Structural]** Engineer licensed in the state where the project is located.
26. **Patching Defective Concrete Finishes**: Submit for action procedures, intended locations, and product information.
27. **Conduit and Pipes Embedded in Concrete:** Submit for action layout of embedded conduit and pipes.
28. **Hazardous Materials Notification**: Submit for record. In the event no product or material is available that does not contain hazardous materials as determined by the Owner, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.
29. **[LEED Submittals:]**

B. Submittal Process

1. Submittal of shop drawings and other submittals by the Contractor shall constitute Contractor's representation that the Contractor has verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each drawing with other Drawings and other trades. The Contractor shall place their shop drawing stamp on all submittals confirming the above.
2. Shop drawings: Submit in complete packages so that individual parts and the assembled unit may be reviewed together. This Specification Section and the applicable Drawings used in the development of the shop drawings shall be referenced on each shop drawing to facilitate checking.
3. The Contractor shall submit to the Design Professionals one (1) electronic copy for shop drawing review. The naming convention of each drawing must follow the submittal numbering system and include the submittal number, Specification number, revision number and drawing number in the prefix of the drawing name.

4. The Contractor shall allow at least **[ten (10)]** working days between receipt and release by the SER for the review of shop drawings and submittals.
5. All modifications or revisions to submittals and shop drawings must be clouded, with an appropriate revision number clearly indicated. The following shall automatically be considered cause for rejection of the modification or revision whether or not the drawing has been approved by the Design Professionals:
   a. Failure to specifically cloud modifications
   b. Unapproved revisions to previous submittals
   c. Unapproved departure from Contract Documents
6. Resubmittals: Completely address previous comments prior to resubmitting a drawing. Resubmit only those drawings that require resubmittal. Do not include new content not previously reviewed.
7. Resubmittals Compensation: The Contractor shall compensate the Design Professionals for submittals that must be reviewed more than twice due to Contractors' errors. The Contractor shall compensate the Design Professionals at standard billing rates plus out-of-pocket expenses incurred at cost + 10%.
8. The Contractor shall deliver to the Design Professionals at the completion of the job two (2) copies of the electronic version of the final as-built shop drawings on a CD-ROM or other media acceptable to the Design Professionals.

C. SER Submittal Review

1. The Design Professionals' review and approval of shop drawings and other submittals shall be for general conformance with the design intent of the work and with the information given in the Contract Documents only and will not in any way relieve the Contractor or the Contractor's Engineer from:
   a. Conforming to the Contract Documents.
   b. Coordination with other trades.
   c. Responsibility for all required detailing and proper fitting of construction work.
   d. The necessity of furnishing material and workmanship required by Drawings and Specifications which may not be indicated on the shop drawings.
   e. Control or charge of construction means, methods, techniques, sequences or procedures, for safety precautions and programs in connection with the work.
2. TYPE 1 – Structural Submittal Review Stamp: For shop drawings for building elements designed by the SER, the responses on the shop drawing review stamp used by the SER require one of the following actions:
   a. APPROVED indicates that the SER has found that the information presented on the shop or erection drawing appears to conform to the requirements of the Contract Documents. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the Contract Documents.
   b. APPROVED AS NOTED indicates that the SER requires the shop or erection drawing to be corrected to reflect the notes and comments shown. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the notations shown on the shop drawings and the Contract Documents. Promptly resubmit the corrected shop or erection drawing for record.
   c. REVISE and RESUBMIT indicates that the SER requires resubmission of the shop or erection drawing after correction per notes and comments. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed until the Contractor has received a returned shop drawing marked Approved or Approved as Noted.

d. NOT APPROVED indicates that the shop or erection drawing does not conform to the Contract Documents and must be extensively revised before re-submittal. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed until the Contractor has received a returned shop drawing marked Approved or Approved as Noted.

3. TYPE 2 – Delegated Design Review Stamp: For submittals for building elements which are not designed by the SER but are delegated design items, or for items that do not form part of the completed structural system but impose loads on the structure, or for construction items or activities which have an effect on the final structure. The responses on the stamp used by the SER require one of the following actions:
   a. NO EXCEPTIONS indicates that the SER has found that the information presented on the submittal appears to conform to the requirements of the Contract Documents. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the Contract Documents.
   b. EXCEPTIONS NOTED indicates that the SER requires the submittal be corrected to reflect the notes and comments shown. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the notations shown on the shop drawings and the Contract Documents. Promptly resubmit the corrected document for record.
   c. REJECTED indicates that the SER requires resubmission of the submittal after correction per notes and comments. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed. Contractor to revise and resubmit until SER response of No Exceptions or Exceptions Noted is received.

D. Substitution Request

1. Requests for any departure from Contract Documents must be submitted in writing by the Contractor and accepted in writing by the Design Professionals, prior to receipt of submittals.
2. All substitutions must be requested using the structural substitution request form included at the end of this section. Acceptance using the structural substitution request form indicates acceptability of the structural concept only. Contractor must submit shop drawings reflecting accepted substitutions for review in accordance with this Specification. The structural substitution request form, even if accepted, does not constitute a change order.
3. Accepted substitutions or modifications shall be coordinated and incorporated in the work at the sole expense of the Contractor.
4. The acceptance by the Design Professionals of a specific and isolated request by the Contractor to deviate from these requirements does not constitute a waiving of that requirement for other elements of, or locations in the project, unless specifically addressed as such and permitted by the Design Professionals in writing.
5. Compensation for Additional Services: Should additional work by Design Professionals such as design, documentation, meetings and/or site visits be required which are necessitated for the review and/or incorporation of the Contractor-requested substitution, including indirect effects on other portions of the work, the Contractor is responsible for paying for additional work performed by the Design Professionals at the standard billing rates plus out-of-pocket expenses incurred at cost + 10%. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.
6. Contractor is responsible for means and methods and any impacts on other portions of the work that may arise from this substitution.

E. Request for Information (RFI)

1. RFIs shall be submitted by the Contractor. RFIs submitted by other entities will be returned with no response.
2. Limit RFI to one subject.
3. Submit RFI immediately upon discovery of the need for interpretation or clarification of the Contract Documents. Submit RFI within timeframe so as not to delay the Construction Schedule while allowing the full response time described below.
4. The response time for answering an RFI depends on the category in which it is assigned.
   a. Upon receipt by the SER, each RFI will be assigned to one of the following categories:
      i. No cost clarification
      ii. Shown in Contract Documents
      iii. Change to be issued in future document revision
      iv. Previously answered
      v. Information needs to be provided by others
      vi. Request for corrective field work
      vii. Request for substitution
   b. RFIs in the first five categories listed above will be turned around by the SER on average of **[five (5)]** working days.
   c. RFIs in the last two categories listed above will be immediately rejected and must be submitted as submittals or requests for substitution.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions and Division 1.

B. Storage:

1. Store materials in accordance with ACI 304R.
2. Store cement in weather-tight buildings, bins or silos that will exclude moisture and contaminates.
3. Store admixtures to avoid contamination, evaporation, damage, and in accordance with manufacturer's temperature and other recommendations.
4. Keep packaged material in original containers with seals unbroken and labels intact until time of use.

C. Handling:

1. Handle fine and coarse aggregates as separate ingredients.
2. Arrange aggregate stockpiles to avoid excessive segregation, and prevent contamination with other materials or with other sizes of like aggregates.
3. Do not use frozen or partially frozen aggregates.
4. Allow sand to drain until it has reached relatively uniform moisture content before use.
5. Protect liquid admixtures from freezing and temperature changes that would adversely affect characteristics, and in accordance with manufacturer's recommendations.

1.8 PRE-CONCRETE CONFERENCE

A. At least 30 working days prior to the start of concrete construction, the Contractor shall hold a meeting to review the proposed concrete mix designs and to determine the procedures for producing proper concrete

construction. The Contractor shall notify the Design Professionals of the meeting and require responsible representatives of every party who is concerned with the concrete Work to attend the conference, including but not limited to the following:

1. Contractor's superintendent.
2. Testing Agency representative responsible for field quality control.
3. Concrete subcontractor.
4. Ready-mix concrete producer.
5. Admixture manufacturer(s).
6. Architect.
7. Structural Engineer.

B. Minutes of the meeting shall be recorded and distributed by the Contractor to all parties concerned within five working days of the meeting. One copy of the minutes shall also be furnished to the following:

1. Design Professionals.
2. Owner's Representative.

C. The minutes shall include a statement by the concrete contractor and admixture manufacturer(s) indicating that the proposed mix design and placing, finishing, and curing techniques can produce the concrete properties and quality required by these Specifications.

1.9 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. See Section 01 4500.

1.10 QUALITY CONTROL BY CONTRACTOR

A. The Contractor shall provide a program of quality control to ensure that the minimum standards specified herein are attained.

B. The Owner's general review during construction and activities of the Testing Agency are undertaken to inform the Owner of performance by the Contractor but shall in no way replace or augment the Contractor's quality control program or relieve the Contractor of total responsibility for quality control.

C. The Contractor shall immediately notify the Design Professionals of any deficiencies in the work which are departures from the Contract Documents. The Contractor shall propose corrective actions and their recommendations in writing and submit them for review by the Design Professionals. After proposed corrective action is accepted by the Design Professionals and Owner, the Contractor shall correct the deficiency at no cost to the Owner. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in the OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS section of this Specification.

D. Where SCC is used, the Ready Mix Producer shall have a Quality Control Representative on site during placements until mix consistency and stability is established.

1.11 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. Observations: The Design Professionals will observe the construction for general compliance with the provisions of the Contract Documents during various phases of construction.

B. Corrections by Design Professionals: See Part 3 - CORRECTIVE MEASURES section of this Specification.

1.12 PERMITS AND WARRANTY

A. Permits: The Contractor shall apply for, procure, renew, maintain, and pay for all permits required by City, State, or other governing authorities, necessary to execute work under this Contract. Contractor shall furnish copies of all permits to the Owner and Design Professionals.

B. Warranty: Comply with General Conditions, agreeing to repair or replace specified materials or work that has failed within the warranty period. Failures include but are not limited to the following:

1. Oily, waxy or loose residue which may interfere with the bonding or discoloration of various applied Architectural finish materials.
2. Discoloration of concrete surfaces scheduled to remain exposed as a finish.
3. Areas which show surface failure or defects.
4. Areas which puddle water.
5. Areas which are not properly prepared to receive Architectural finish materials. If necessary, the Contractor, at his own expense, shall have the Testing Agency perform appropriate tests for bond and discoloration.
6. Patches that become crazed, cracked or sound hollow when tapped.
7. Self-leveling concrete topping that has cracked, spalled and/or not performed in accordance with manufacturer's design criteria.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS AND PRODUCTION

A. Portland Cement:

1. ASTM C150, Type I or Type II
2. ASTM C150, Type III, High-early Strength Portland Cement may be used subject to review and approval of the SER. The specified 28-day concrete compressive strength shall occur within 7 days for concrete using Type III Portland Cement.
3. **[ASTM C150, Type V [or Type II/V]]**
4. Provide the same brand of Portland Cement from a single source throughout the project, as required to meet Design Professionals' requirements.

B. Blended Hydraulic Cement:

1. ASTM C595, Type IL, Portland-Limestone Cement
2. ASTM C595, Type IS, Portland-Slag Cement
3. ASTM C595, Type IP, Portland-Pozzolan Cement

4. ASTM C595, Type IT, Ternary-Blended Cement

C. Aggregates for Normalweight Concrete:

1. ASTM C 33
2. Fine Aggregate: Natural sand, or sand prepared from stone or gravel, clean, hard, durable, uncoated and free from silt, loam and clay.
3. The acceptability of aggregates for the work will depend on proof that their potential alkali reactivity is not deleterious to the concrete.
4. Do not use fine or coarse aggregates that contain substances that cause spalling.
5. Maximum coarse aggregate size shall conform to the requirements as specified in ACI 301 but shall not exceed the following:

   Size no. 57 (25mm max) for footings, drilled piers and caissons
   Size no. 67 (20mm max) for all other locations
   Size no. 467 or 457 for non-reinforced concrete at locations noted on Drawings.

6. Contractor shall furnish concrete with maximum 3/8" (10mm) aggregate at no additional cost to the Owner if areas of high reinforcement density require it for placement and consolidation.

D. Aggregates for Lightweight Concrete:

1. ASTM C 330: Except aggregates prepared by processing natural materials, such as pumice, scoria, or tuff.
2. Classification of Aggregates: As required to meet Design Professional's requirements.
3. Provide aggregates from a single source throughout the project for exposed concrete.
4. Aggregate shall contain the minimum absorbed moisture content recommended by the manufacturer for the project prior to batching.
5. Maximum coarse aggregate size shall conform to the requirements as specified in ACI 301 but shall not exceed ¾" (20mm)

E. Water: ASTM C 1602. Clean, and free from injurious amounts of oil, acids, alkali, salts, organic material, or other deleterious materials.

F. Supplementary Cementitious Material

1. Fly Ash: ASTM C 618, Class C or Class F.
2. Slag Cement: ASTM C 989.
3. Silica Fume (Microsilica): ASTM C1240.
   a. Acceptable Products:
      i. Force 10,000 D by GCP Applied Technologies, Inc.
      ii. Eucon MSA by Euclid Chemical Company
      iii. MasterLife SF 100 by Master Builders Solutions
      iv. Sikacrete 950 DP by Sika Corporation

4. Metakaolin: ASTM C 618, Class N.
   a. Acceptable Products:
      i. MasterLife MK828 by Master Builders Solutions
      ii. HRMK 100 by GCP Applied Technologies, Inc.
      iii. Sikacrete M-100 by Sika Corporation

5. For concrete assigned to Exposure Classes F1 and F2, as defined in ACI 318, there is no limit to the maximum amount of supplementary cementitious materials included in the mix as a percentage of total cementitious materials by mass.
6. For concrete assigned to Exposure Class F3 as defined in ACI 318, limits to the maximum amount of supplementary cementitious materials included in the mix as a percentage of total cementitious materials by mass are as follows:
   a. Fly ash or other pozzolans conforming to ASTM C618 = 25%
   b. Slag cement = 50%
   c. Silica fume = 10%
   d. Total of fly ash or other pozzolans and silica fume = 35%
   e. Total of fly ash or other pozzolans, slag cement and silica fume = 50%
   f. The maximum percentage limits listed above shall include the supplementary cementitious materials used in the manufacture of ASTM C595 blended cements.

7. The fly ash or natural pozzolan supplier shall have an effective quality control program in place to guard against contamination of the fly ash and assure compliance with Specifications.
8. Supplementary Cementitious Materials shall be from one source throughout the project. Substitution of sources will be acceptable only if testing of concrete mixes containing the substituted material show similar test results and if the color of concrete produced with the substituted material matches the color of previously poured concrete to the satisfaction of the Architect.

G. Ready Mixed Concrete:

1. Shall be batch-mixed and transported in accordance with ASTM C 94.

H. Self-Consolidating Concrete:

1. Produce in accordance with ACI 237R.
2. Perform the following tests and provide report prior to submitting mix design:
   a. Resistance to Segregation: Achieve a maximum static segregation percentage of 15% when tested according to ASTM C 1610 with a VSI index of 1 maximum.
   b. Slump Flow: ASTM C 1611 within a range **of [20"-30" (500mm–750mm)]**.
   c. Passing Ability: ASTM C 1621 with a maximum difference of 2" (50mm) between testing with and without the J-Ring.

2.2 CONCRETE MIX DESIGN

A. Concrete Strength:

1. Shall be as indicated on the Structural Drawings
2. Where concrete strength is not indicated on the drawings, the minimum concrete strength for exposure classes as defined in ACI 318 are as follows:
   a. F0, S0, W0, C0, C1 = 2500 psi
   b. F1 = 3500 psi
   c. S1, W1 = 4000 psi
   d. F2, S2, S3, = 4500 psi
   e. F3, C2 = 5000 psi

B. Concrete Density (Unit Weight):

1. Shall be as indicated on the Structural Drawings

C. Air Entrainment

1. For concrete exposed to freeze/thaw cycles and/or deicing chemicals (ACI 318 Exposure Classes F1, F2, F3), and concrete intended to be watertight, provide entrained air content of 6% ± 1.5%, unless specified otherwise. This includes, but is not limited to, concrete at the following locations:
   a. Concrete at the exterior of the structure with at least one surface exposed to weather, such as exterior face of grade beams, foundation walls, exterior walls and parapets, exposed columns and edge beams.
   b. Floor framing and ramps in parking garages.
   c. Loading docks.
   d. Balconies and terraces with no waterproofing membrane.

2. For lightweight concrete less than 120 pcf (19 kN/m³) density, air content may be up to 7% regardless of exposure condition.
3. For concrete with a specified compressive strength (f'c) greater than 5000 psi (35MPa), required air content may be reduced to 5% ± 1.5%.
4. Entrained air content noted above shall occur at point of delivery.
5. No entrained air content is required for foundations with no surface exposed to weather.
6. All interior steel trowel finished, normal weight slabs shall have a maximum air content of 3%.

D. Water-Cementitious Material Ratio (w/cm) for Normalweight Concrete

1. The total combined weight of Portland cement and all other supplementary cementitious material shall be used to determine the w/cm.
2. The w/cm shall not exceed the values indicated below, including any water added to meet specified slump in accordance with the requirements of ASTM C 94.
3. Based on Exposure Class, as defined in ACI 318, the following maximum w/cm shall be provided:
   a. Exposure Class F0, S0, W0, C0, C1, no maximum
   b. Exposure Class F1, max w/cm=0.55
   c. Exposure Class S1, W1, max w/cm=0.50
   d. Exposure Class F2, S2, S3, max w/cm=0.45
   e. Exposure Class F3, C2, max w/cm=0.40

4. [Concrete used in slab on grade shall have a maximum w/cm ratio of 0.45.]

E. Slump

1. Concrete design mixes shall be proportioned to meet the following slump limitations. Slump should be measured as described in the Testing Agency responsibilities:
   a. Concrete with high range or mid range water-reducing admixture: Concrete slump prior to addition of high range water-reducing admixture shall not exceed 3" +/- 1" (75mm) for normalweight concrete and 4" +/- 1" (100mm) for lightweight concrete. After addition of water-reducing admixture, the concrete shall have a maximum slump of 9" +/- 1" (225mm) unless otherwise approved by the SER.
   b. Concrete without a water-reducing admixture: Slump shall not exceed 4" +/- 1".

F. Self-Consolidating Concrete Slump/Flow: Use for concrete exposed to view and heavily reinforced areas where indicated on the plans, and where conventional mixtures do not provide adequate consolidation. Minimum slump/flow diameter of **[20" (500mm)]** or as required by the successful test placement onsite, which shall verify proper workability, finish, and setting time. All self-consolidating concrete shall contain the specified high range water-reducing admixture. All self-consolidating concrete shall contain viscosity modifying admixture as required unless proper quantity and grading of fines can be achieved.

G. Chloride Ion Content

1. The total water-soluble chloride ion content of the mix including all constituents shall not exceed the limits defined in ACI 318 unless corrosion inhibiting admixtures are added to the mixture to offset the additional chloride.
2. If the specified level of water-soluble chloride ion content cannot be maintained, appropriate level of corrosion inhibiting admixture shall be added to the mix in accordance with the manufacturer's recommendation to offset the excess amount of chloride at no additional cost to the Owner.

2.3 ADMIXTURES

A. General:

1. Admixtures specified below can be used only when established in the mix design with Design Professionals' prior written approval.
2. Each admixture approved by Design Professionals shall be used in strict compliance with manufacturer's published instructions.
3. Concrete supplier shall certify all admixtures to be compatible with each other. (See Submittals Section in Part 1)

B. Air Entraining Admixture:

1. ASTM C 260
2. Acceptable Products:
   a. MasterAir Series by Master Builders Solutions
   b. Darex Series or Daravair Series by GCP Applied Technologies, Inc.
   c. EUCON AEA –92 or EUCON Air Series by Euclid Chemical Company
   d. AIR Series or AEA-14 by Sika Corporation

C. Water-Reducing Admixture:

1. ASTM C 494, Type A
2. Acceptable Products:
   a. MasterPozzolith Series by Master Builders Solutions
   b. EUCON NW or EUCON WR 91 by Euclid Chemical Company
   c. WRDA Series, Zyla Series or Mira Series by GCP Applied Technologies, Inc.
   d. Plastocrete Series by Sika Corporation

D. Retarding Admixture:

1. ASTM C 494, Type B
2. Acceptable Products:

a. MasterSet R Series or MasterSet DELVO Series by Master Builders Solutions
b. EUCON RETARDER 100 by Euclid Chemical Company
c. Daratard 17 by GCP Applied Technologies, Inc.
d. Plastiment Series by Sika Corporation

E. Non Corrosive Accelerating Admixture:

1. ASTM C 494, Type C
2. Acceptable Products:
   a. MasterSet FP 20 or MasterSet NC 534 by Master Builders Solutions
   b. ACCELGUARD 80, ACCELGUARD NCA or ACCELGUARD 90 by Euclid Chemical Company
   c. Daraset" Series, Polarset, or DCI by GCP Applied Technologies, Inc.
   d. Sikaset Series or Rapid-1 by Sika Corporation

F. Water-Reducing and Retarding Admixture:

1. ASTM C 494, Type D
2. Acceptable Products:
   a. MasterSet R Series or MasterSet DELVO Series by Master Builders Solutions
   b. EUCON RETARDER 75 or EUCON DS by Euclid Chemical Company
   c. Daratard 17 or Recovery Series by GCP Applied Technologies, Inc.
   d. Plastiment Series by Sika Corporation

G. Water-Reducing and Accelerating Admixture:

1. ASTM C 494, Type E
2. Acceptable Products:
   a. MasterSet FP 20 by Master Builders Solutions
   b. ACCELGUARD 80 or ACCELGUARD 90 by Euclid Chemical Company
   c. Libricon NCA by GCP Applied Technologies, Inc.
   d. Sikaset NC by Sika Corporation

H. Mid-Range Water-Reducing Admixture:

1. ASTM C 494, Type A
2. Acceptable Products:
   a. MasterPolyheed Series by Master Builders Solutions
   b. Daracem or Mira by GCP Applied Technologies, Inc.
   c. Sikaplast Series or Sikament Series by Sika Corporation
   d. Eucon MR or Eucon MRX by Euclid Chemical Company

I. High-Range Water-Reducing Admixture:

1. ASTM C 494, Type F
2. Acceptable Products:
   a. MasterGlenium Series by Master Builders Solutions
   b. EUCON 37 or PLASTOL SERIES by Euclid Chemical Company
   c. Daracem or ADVA Series by GCP Applied Technologies, Inc.
   d. Viscocrete Series or Sikament Series by Sika Corporation

J. High-Range Water-Reducing Admixture for production of Control Flow Concrete:

1. ASTM C494 Type A and F and ASTM C1017 Type I
2. Acceptable Product:
    a. CONCERA SA8080 by GCP Applied Technologies, Inc.

K. High-Range Water-Reducing and Retarding Admixture:

1. ASTM C 494, Type G
2. Acceptable Products:
    a. EUCON 537 by Euclid Chemical Company
    b. Daracem Series or Adva Series by GCP Applied Technologies, Inc.

L. Workability Retaining Admixture:

1. ASTM C494, Type S
2. Acceptable Products:
    a. MasterSure Z-60 by Master Builders Solutions
    b. Visco Flow-2020 by Sika Corporation

M. Permeability-Reducing Admixture:

1. ASTM C494, Type S
2. Shall be a Portland cement based crystalline capillary waterproofing admixture that reacts in concrete to form non-soluble crystalline hydration products in the capillary pores of concrete,
3. Acceptable Products:
    a. MasterLife 300D and 300C by Master Builders Solutions
    b. Eucon Vandex AM-10 by Euclid Chemical Company
    c. Admix C-Series by Xypex

N. Viscosity Modifying Admixture (VMA) for Self-Consolidating Concrete (SCC):

1. ASTM C 494, Type S
2. Acceptable Products:
    a. MasterMatrix VMA Series by Master Builders Solutions
    b. V-MAR3 by GCP Applied Technologies, Inc.
    c. EUCON ABS or EUCON WO or VISCTROL by Euclid Chemical Company
    d. Sika Stabilizer-4R by Sika Corporation

O. Corrosion Inhibiting Admixtures:

1. Calcium Nitrite Based: ASTM C 1582 and ASTM C 494, Type C, 30% + 2% solution
    a. Acceptable Products:
        i. DCI or DCI-Sby GCP Applied Technologies, Inc.
        ii. MasterLife CI 30 by Master Builders Solutions
        iii. EUCON CIA by Euclid Chemical Company
        iv. Sika-CNI by Sika Corporation

2. Amine Carboxylate Based: ASTM C 1582, which includes ASTM C-494 amine carboxylate
    a. Acceptable Product:

i. MCI 2005, MCI 2005 NS, MCI 2006 or MCI 2006 NS by Cortec Corporation

3. Amino Alcohol Based:
   a. Acceptable Product:
      i. FerroGard 901 by Sika Corporation
      ii. MasterLife CI 222 by Master Builders Solutions

P. Shrinkage Reducing/Compensating Admixtures:

1. ASTM C 494, Type S
2. Acceptable Products:
   a. Eclipse Floor 200 or Eclipse 4500 (for use with air-entrained concrete) by GCP Applied Technologies, Inc.
   b. Conex or EUCON SRA Floor or EUCON SRA-XT (for use with air-entrained concrete) by Euclid Chemical Company
   c. MasterLife SRA Series or MasterLife CRA 007 by Master Builders Solutions
   d. SikaControl 75 by Sika Corporation
   e. PREVent-C by PremierCPG

Q. Alkali-Silica Reaction Inhibiting Admixture:

1. ASTM C 494, Type S
2. Shall contain a nominal lithium nitrate content of 30 percent.
3. Dosage to be determined in accordance with US Army COE CRD-C662
4. Acceptable Products:
   a. MasterLife ASR 30 by Master Builders Solutions
   b. Eucon Integral ARC by Euclid Chemical Company
   c. RASIR by GCP Applied Technologies

R. Porosity Inhibiting Admixture:

1. ASTM C494, Type S
2. Sodium silicate free
3. Manufacturer must be able to provide a flooring adhesion guarantee and life of the concrete vapor transmission warranty. In order to obtain warranty, product must be installed in compliance with the manufacturer's published data sheet including but not limited to proper on-site representation, mix design review, concrete testing and installation of vapor retarder for slabs on ground.
4. Acceptable Products:
   a. Barrier One by Concrete Moisture Solutions, Inc.
   b. MVRA 900 by ISE LOGIK Industries

S. Carbon Dioxide ($C0_2$) Mineralization:

1. Where called for on the drawings or when approved by the SER, provide concrete that has undergone carbonization treatment with carbon dioxide ($C0_2$) during mixing, such that $C0_2$ is chemically mineralized into the concrete.
2. $C0_2$ injected into the mix must be post-industrial $C0_2$ sourced from a nearby emitter. Provide concrete producer's certificate outlining quantity, location and supplier of $C0_2$.
3. Acceptable Product:
   a. Carbon Cure by CarbonCure Technologies.

2.4 ADHESIVES

A. Epoxy Bonding Agent for bonding hardened concrete to hardened concrete (existing concrete damp or dry, at least 28 days old, no surface water):

1. ASTM C 881 Type IV, Grade 1, 2 or 3, Class B or C as appropriate for field temperature conditions.
2. Acceptable Products:
    a. Acceptable Product: Dural 452 Series by Euclid Chemical Company
    b. Rezi-Weld 1000 by W. R. Meadows
    c. Sure Bond J58 by Dayton Superior

B. Epoxy Bonding Agent for bonding freshly mixed concrete to hardened concrete (existing concrete damp or dry, less than 28 days old, no surface water):

1. ASTM C 881, Type V, Grade 1, 2, or 3, Class B or C as appropriate for field temperature conditions.
2. Acceptable Products:
    a. Dural 452 Gel or 452 MV by Euclid Chemical Company
    b. Sikadur 32 Hi-Mod by Sika Corporation
    c. Rezi-Weld 1000 by W. R. Meadows
    d. Sure Bond J58 by Dayton Superior

C. Anti-Corrosive Epoxy Modified Cementitious Bonding Compound and Corrosion Protection of Reinforcement (bonding agent for existing concrete saturated surface dry, no surface water):

This adhesive shall be a water-based epoxy/cementitious compound for adhesion and corrosion protection of reinforcing members (20 hour maximum open time).

1. Acceptable Products:
    a. DURALPREP AC by Euclid Chemical Company
    b. ARMATEC 110 EpoCem by Sika Corporation
    c. MasterEmaco P124 by Master Builders Solutions
    d. Perma Prime 3C by Dayton Superior

2.5 CURING COMPOUNDS AND SEALERS

A. Interaction with finishes:

1. See architectural Drawings for finish material applied over concrete.
2. Use only curing and sealer compounds that are compatible with finish, waterproofing or roofing material.

B. Curing and Sealing Compound (VOC Compliant, 350 g/l) :

1. ASTM C1315, Type I, Class A and/or ASTM C 309, Type 1, Class A or B
2. Water based acrylic, clear, 25% solids curing and sealing compound.
3. Acceptable Products:
    a. Super Diamond Clear VOX by Euclid Chemical Company
    b. Cure & Seal 1315 J22WB by Dayton Superior
    c. VOCOMP-25 by W. R. Meadows

d. Dress & Seal WB 30 or Lumiseal WB by Laticrete International, Inc.
e. [MasterKure CC 1315WB by Master Builders Solutions**]**

C. Curing Compound-Dissipating/Strippable (VOC Compliant, 350 g/l):

1. ASTM C 309, Type I, Class A or B
2. Water based resin, clear curing compound that begins to dissipate when exposed to UV light and traffic.
3. Acceptable Products:
   a. Kurez DR VOX by Euclid Chemical Company
   b. Clear Resin Cure J11W by Dayton Superior
   c. 1100 by W. R. Meadows

D. Curing and Durability-Increasing Compound, Spray Applied

1. Shall conform to state and federal VOC regulations with zero VOC content.
2. Not to be used with Moisture Vapor Reducing Admixtures, Integral Waterproofing Admixtures, or Latex Admixtures
3. Acceptable Products:
   a. P3 Protect by Spray-Lock Concrete Products

E. Surface Applied Vapor Emission Mitigation

1. Shall conform to state and federal VOC regulations with zero VOC content.
2. Shall provide a 15 year warranty against flooring failure due to negative-side moisture vapor migration of moisture-born alkalinity.
3. Acceptable Products:
   a. CS2000 by Creteseal
   b. SCP 327 by Spray-Lock Concrete Protection

F. Liquid Densifier/Sealer:

1. The liquid densifier compound shall be a silicate based compound that penetrates and chemically hardens concrete surfaces.
2. Acceptable Products:
   a. Euco Diamond Hard by Euclid Chemical Company
   b. Acceptable Product: Dayton Superior “Densifier J13”
   c. MasterKure HD 200WB by Master Builders Solutions
   d. Liqui-Hard by W. R. Meadows

G. Evaporation Retarder:

1. Acceptable Products:
   a. MasterKure ER50 by Master Builders Solutions
   b. Eucobar by Euclid Chemical Company
   c. Sika Film by Sika Corporation

2.6 DRY SHAKE HARDENERS

A. Mineral Aggregate Hardener:

1. The specified mineral aggregate hardener shall be a factory-blended mixture of specially processed graded non-metallic aggregate.
2. Acceptable Products:
   a. Euclid Chemical Company, "Surflex" to be used with “Kurez DR VOX”
   b. MasterTop 100 to be used with “MasterKure CC 200WB by Master Builders Solutions
   c. Quartzplate FF to be used with Dress & Seal WB 30 by Laticrete International, Inc.

B. Non-Oxidizing Metallic Hardener:

1. The specified non-oxidizing metallic floor hardener shall be a mixture of specially processed non-rusting aggregates.
2. Acceptable Products:
   a. Euclid Chemical Company, “Diamond-Plate” to be used with “Kurez DR VOX”
   b. MasterTop 210COR to be used with “MasterKure CC 200WB by Master Builders Solutions
   c. Emeryplate FF to be used with Lumiseal WB by Laticrete International, Inc.

2.7 MISCELLANEOUS CONCRETE AND CONCRETE RELATED PRODUCTS

A. Cementitious Non-Shrink Grout:

1. Provide pre-packaged high-precision, non-shrink, non metallic grout.
2. See General Notes for grout minimum compressive strength.
3. ASTM C 1107
4. Acceptable Products:
   a. MasterFlow 928 by Master Builders Solutions
   b. Dry Pack Grout or HI-FLOW GROUT by Euclid Chemical Company
   c. Five Star Grout by Five Star Products
   d. Sikagrout 328 by Sika Corporation
   e. Duragrout by Latticrete International, Inc.

B. Self-Leveling Concrete Topping - Underlayment for Interior Applications:

1. Use self-leveling underlayment concrete formulated to level concrete floors without shrinking, cracking or spalling, and capable of being placed from feathered edge to 1" (25mm) thickness without aggregate in one pour. If greater than 1" (25mm) thickness is required, aggregate shall be extended with aggregate in accordance with manufacturer's requirements. Appropriate primer shall be utilized for all underlayment applications.
2. Acceptable Products:
   a. K-15 by Ardex
   b. Flo-Top or Super Flo-Top by Euclid Chemical Company
   c. Sika Level Series by Sika Corporation

C. Moisture-Retaining Covers:

1. ASTM C171

2. A naturally colored, non-woven polypropylene fabric with a non-perforated reflective polyethylene coating containing stabilizers to resist degradation from ultraviolet light. Fabric shall exhibit low permeability and high moisture retention.
3. Acceptable Products:
   a. Hydracure S-16 by PNA Construction Technologies, Inc.
   b. Transguard 4000 by Amorlon a Division of Reef Industries , Inc.
   c. UltraCure NCF by Sika Corporation
   d. Top Cure by Transhield

D. Expanded Polystyrene (EPS) used as Fill - Geofoam

1. Material: Rigid, closed cell polystyrene blocks formed by expansion of polystyrene beads by steam.
2. Comply with the requirements of ASTM D 6817
3. Unless noted otherwise on the drawings, provide the following types of EPS:
   a. Fill between a lower slab and a raised slab area: EPS12 -2.2 psi (15 kPa) compressive resistance minimum at 1% deformation, 10 psi (70 kPa) flexural strength minimum
   b. Fill below exterior floor slabs or slabs with truck loading: EPS19 - 5.8 psi (40 kPa) compressive resistance minimum at 1% deformation, 30 psi (200 kPa) flexural strength minimum

4. Thickness as indicated on Drawings.
5. Execution: Conform to manufacturer's instructions regarding preparation, installation and protection
6. Gripper plates shall be used as needed to restrain EPS from moving laterally in multi-layer applications
7. Contractor shall sequence soil or concrete topping placement to avoid EPS block shift or flotation.
8. Submit the following for review:
   a. Manufacturer's product literature including physical properties in compliance with ASTM D 6817 and type specified
   b. 10 year physical property warranty
   c. Proposed plan layout of fill blocks showing gaps between blocks where required for stabilizing and/or load bearing reinforced concrete ribs as shown on drawings, in details or in notes.

9. Submit the following for record:
   a. Summary of test compliance with specified performance characteristics and physical properties
   b. Product Certificates showing evidence of third party quality control

10. Acceptable Manufacturers:
    a. ACH Foam Technologies
    b. Atlas EPS
    c. Universal Construction Foam

E. Vapor Retarder: See Division 7, Thermal and Moisture Protection

F. Non-Slip Aggregate:

1. Abrasive crushed and graded aggregate, high in aluminum oxidegregate which is unaffected by moisture or cleaning compounds.
2. Acceptable Products:
   a. Non-Slip Aggergate by Euclid Chemical Company

b. Emery Non-Slip by Dayton Superior
c. A-H Emery Emerundum by Anti-Hydro International, Inc.

2.8 CONCRETE REPAIR MATERIALS

A. Polymer-Modified Repair Mortar

1. The following patching mortars may be used when color match of the adjacent concrete is not required. Prior approval by the Design Professionals is required.
2. Acceptable Products-Horizontal Surfaces:
   a. Tammspatch II or Tamms Thin Patch by Euclid Chemical Company
   b. Sikatop 122 Plus by Sika Corporation
   c. Meadow-Patch T1 or T2 or Meadow-Crete GPS by W. R. Meadows
   d. Duracrete by Laticrete International, Inc.

3. Acceptable Products-Vertical and Overhead Surfaces:
   a. MasterEmaco N400 by Master Builders Solutions
   b. Verticoat, Vertacoat Supreme or Dualtop Gel by Euclid Chemical Company
   c. SikaTop 123 Plus by Sika Corporation
   d. Meadow-Crete GPS by W. R. Meadows

B. Crack Repair:
   a. Euco Qwikstitch or Dural 50 LM by Euclid Chemical Company
   b. MasterSeal 630 by Master Builders Solutions
   c. T78 Methyl Methacrylate Crack Sealer by Transpo Industries, Inc.

C. High Strength Flowing Repair Concrete:

1. For forming and pouring large volume repairs, provide shrinkage compensated repair concrete with integral corrosion inhibitor.
2. Minimum compressive strength 8000 psi (56MPa) @ 28-days
3. Prior approval by the Design Professionals is required for cold weather applications
4. Acceptable Products:
   a. Eucocrete by Euclid Chemical Company
   b. MasterEmaco S 466 CI by Master Builders Solutions
   c. Meadow-Crete FNP by W. R. Meadows

D. Epoxy Injection:

1. ASTM C881
2. Acceptable Products:
   a. MasterInject 1380 by Master Builders Solutions
   b. Dural Injection Gel by Euclid Chemical Company
   c. Sikadur 35 LV LPL by Sika Corporation
   d. Rezi-Weld LV State by W. R.Meadows

E. Pressure-Injected Foam Resin:

1. Acceptable Products:

a. De Neef Sealform PURe by GCP Applied Technologies
b. Crack-Pac Flex-H2O by Simpson Strong-Tie
c. SikaFix HH LV by Sika Corporation

F. Semi Rigid Joint Filler:

1. Acceptable Products:
   a. MasterSeal CR 190 by Master Builders Solutions
   b. Euco 700 or Qwikjoint UVR by Euclid Chemical Company
   c. MM-80 by Metzger/McGuire
   d. Rezi-Weld Flex by W. R, Meadows

G. Methyl Methacrylate (MMA)

1. Acceptable Products:
   a. MasterSeal 630 by Master Builders Solutions
   b. Transpo Industries, Inc. “T-78 Methyl Methacrylate Polymer Crack Healer/Sealer”
   c. MMA #884 by Epoxy Systems

H. Sealant:

1. Silicone or Polyurethane Sealant (as selected based on project requirements such as loading, traffic, bond, coatings, etc.).
2. Joint to be routed and cleaned per manufacturer’s written directions.
3. Acceptable Products:
   a. MasterSeal Sealants by Master Builders Solutions
   b. Sikaflex-1C SL and Loadflex 524 EZ by Sika Corporation
   c. Pourthane NS by W. R. Meadows
   d. Eucolastic 1NS by Euclid Chemical Company

2.9 FIBER REINFORCEMENT

A. General:

1. Fiber reinforcement specified below can be used only with Design Professional’s prior written approval.
2. See Drawings for location of Fibers.
3. Where macro synthetic fiber reinforcement is proposed as a substitution request to replace welded wire reinforcement, Contractor shall demonstrate that proposed material and dosage rate provides equivalent performance to the welded wire reinforcement indicated on Drawings.
4. Fiber reinforcement shall not replace reinforcing bars shown on Drawings.

B. Synthetic Macro Fibers (high volume synthetics used for reduction of plastic and drying shrinkage cracking)

1. ASTM C 1116, Type III polyolefin fibers engineered and designed for use in making fiber-reinforced concrete.

2. The fibers shall provide a minimum equivalent flexural residual strength (fe_3) of 150 psi (1.0 MPa), unless otherwise noted on the drawings, when tested in accordance with ASTM C1609.
3. When synthetic macro fibers are used as a replacement for welded wire reinforcement in composite slabs, contractor shall submit documentation that the fibers are Underwriters Laboratories (UL) certified for the fire ratings as indicated on the drawings. Provide dosage of fibers as required to meet the fire resistance rating but not less than 4 pounds per cubic yard (2.4 kg/m^3).
4. Acceptable Products:

    a) Strux 90/40 by GCP Applied Technologies, Inc.
    b) Tuf-Strand SF by Euclid Chemical Company
    c) Fibermesh 650-e3 by Sika Corporation
    d) MasterFiber MAC 100 by Master Builders Solutions
    e) FORTO-FERRO by Forta Concrete Fiber
    f) FiberForce 650 and 750 by ABC Polymer Industries, LLC

PART 3 - EXECUTION

3.1 TOLERANCES

A. Work shall conform to all requirements of ACI 117 except as modified by more stringent requirements in the Project Specifications and/or Drawings.

3.2 PREPARATION

A. Subgrade:

1. Dampen subgrades not covered with membrane by sprinkling immediately before placing concrete.
    a. Omit when subgrade is already damp.

2. Do not place on water-saturated subgrade unless placing can be done without damage to subgrade (surface is stable) and loading the subgrade does not drive free water to the surface.
3. Do not place concrete on frozen ground.

B. Forms:

1. Coordinate with Section 03 1000 Concrete Formwork.
2. Remove dirt, sawdust, nails and other foreign material from formed space.
3. Dampen wood forms by sprinkling immediately before placing.
4. Cool metal forms by sprinkling immediately before placing.

C. Concrete Accessories:

1. Coordinate with Section 03 1000 Concrete Formwork.

D. Dewatering:

1. Remove water from concrete formwork.
2. Divert any flowing water to sump and remove by pumping.
3. Refer to Division 1 for additional dewatering requirements.

E. Vapor Retarder Placement: See Division 7, Thermal and Moisture Protection.

3.3 JOINTS IN CONCRETE

A. Locate construction and contraction joints as indicated on Drawings and on approved joint location submittal.

1. Do not use contraction joints in framed floors or composite slabs.
2. Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Design Professionals.
3. Coordinate location of construction and contraction joints with locations of joints in finish materials where they exist.
    a. Construction and contraction joints in slabs or slab on grade with terrazzo finish must be reviewed and approved by the Design Professionals.

4. Maximum joint spacing is as indicated on Drawings.

B. Construction Joints:

1. Construction joints shall be located within the central third of the span. Any concrete spilling over or through the bulkhead shall be removed at the completion of the pour. All surfaces of the concrete shall have reinforcing extending through the joint.
2. Horizontal Joints: Horizontal construction joints other than those shown on the Drawings will not be permitted unless approved by the Architect.
3. Joint Preparation: Forms shall be removed in time to permit roughening of construction joints of structural members by chipping and wire brushing to remove all loose and foreign material and roughen as indicated on the Drawings. The existing concrete at joints shall either be (a) dampened to the point that the surface is saturated, but all standing water has been removed, promptly followed by placement and vibration of fresh concrete, or (b) not required to be dampened, with one of the specified bonding compounds applied as appropriate for the joint condition, following manufacturer recommendations, with placement and vibration of fresh concrete to follow while the epoxy bonding agent is still tacky. Joints without epoxy bonding agent require fresh concrete with slump 7 inches (180mm) or greater at horizontal joints, and fresh concrete confined to maintain pressure against the joint at vertical joints. Where such conditions are not present, or where applying water to dampen the surface is impractical, use epoxy bonding agent suitable for dry surfaces

C. Isolation Joints:

1. Interrupt structural continuity resulting from bond, reinforcement or keyway at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls and other locations, as indicated.

D. Contraction Joints in Floor Slabs-on-Grade:

1. Maximum slab area controlled by jointing is 400 square feet (35 square meters).

2. Space joints at 36 times slab thickness unless a smaller spacing is indicated on the Drawings, located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
3. Contraction joints can be provided by sawcuts, formed joints or appropriately detailed construction joints.
4. Sawcuts shall be made as soon as possible after slab finishing as may be safely done without dislodging aggregate. The Soff-Cut saw shall be used to a depth of ¼ of slab thickness immediately after final finishing. Conventional saw shall be used as soon as possible after final finish without raveling to a depth as indicated on the Drawings.
5. Where contraction joints coincide with construction joints, detail joint as indicated on Drawings.

E. Joint Fillers: Coordinate with Section 03 2000 Concrete Reinforcement and Embedded Assemblies and Division 7 requirements.

3.4 MIXING

A. Measurement of Materials: Conforming to ASTM C 94.

B. Mixing: All concrete shall be ready-mixed conforming to ASTM C 94 except as follows:

1. Provide concrete materials, proportions and properties as herein specified in lieu of ASTM C 94.
2. Water, beyond that required by the mix design, shall not be added at the Project site. Addition of water at the Project site shall be made only in the presence of the Testing Agency.
3. Furnish delivery ticket with each load of concrete delivered to the site to the Contractor conforming to the requirements of ASTM C 94.

C. High range water reducing agents (superplasticizer), if added at the batch plant, may be added again at the Project site.

1. If superplasticizers are added at the batch plant, the concrete mix design must account for the delivery time, workability, finishability, and setting time required on the jobsite for proper placing and finishing procedures.
2. If the superplasticizer is redosed at the jobsite in air entrained concrete, air content must be checked after mixing.

D. Discharge of the concrete shall be completed within 1-1/2 hours , after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. If the 1-1/2 hour limit cannot be achieved due to project location or other project specific conditions, hydration control measures to extend the proper workability up to 4 hours maximum can be proposed for approval by the SER. The increased time period along with redosing of the high range water reducer and/or use of hydration controlling/workability retaining admixtures should be agreed upon at the pre-concrete conference.

3.5 CONCRETE PLACEMENT

A. Prior to Concrete Placement:

1. Mechanical vibrators are required and must be available for placing concrete.
2. Remove debris from space to be occupied with concrete.
3. Notify Design Professionals**,** and Testing Agency 48 hours prior to starting concrete placement.

4. Approved mix designs must be maintained on file in Contractor's Field Office.
5. Reinforcement and accessories shall be in proper locations, clean, free of loose scale, dirt or other foreign coatings that may reduce bond to concrete, and in accordance with Section 03 2000 and Drawings.
6. Do not place concrete having a slump outside of allowable slump range.
7. Place concrete before initial set has occurred, but in no event after it has been discharged from the mixer more than 30 minutes. All concrete shall be placed upon clean, damp surfaces, free from puddled water, or upon properly consolidated fills or upon Controlled Low-Strength Material with a strength between **[50 and 1200]** psi. Placement upon soft mud or dry earth is not permitted.
8. Unless adequate protection is provided, concrete shall not be placed during rain.
9. Rain water shall not be allowed to increase mixing water or to damage the surface finish.
10. At surfaces left exposed to view, do not use equipment in placing and finishing concrete that contain aluminum in the finishing edges that come in contact with the concrete surface.
11. Keep subgrade moisture uniform without puddles or dry areas.
12. Place vapor retarder directly below slabs on grade as specified in Contract Documents.

B. For Conduits and Pipes Embedded in Concrete:

1. For concrete slab, wall, beam or column, conform to requirements of ACI 318. For variations from these requirements, submit a written request for Design Professionals' review and response.
2. Conduits and pipes shall not be embedded in concrete slabs on steel deck without approval of Design Professional.
3. Provide sleeves for pipes passing vertically through concrete.
4. Do not embed aluminum materials.
5. Do not cut, bend or displace the reinforcement to facilitate placement of embedded pipes and conduits.

C. Pumping: Pumping shall be done in strict accordance with ACI 304.2R.

D. Placing Concrete in Forms:

1. Clean and prepare forms as specified in Section 03 1000/Concrete Formwork.
2. Place concrete continuously without interruption between predetermined construction and contraction joints in walls.
3. Deposit concrete in forms in horizontal layers no deeper than 24” (600mm) and in a manner to avoid inclined construction joints.
4. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
5. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping.
6. Use equipment and procedures for consolidation of concrete in accordance with ACI 309R.
7. Do not use vibrators to move fresh concrete laterally inside forms from discharge point; shift discharge point as needed.
8. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine.
9. Place vibrators to rapidly penetrate placed layer and at least 6" (150mm) into preceding layer.
10. Do not insert vibrators into lower layers of concrete that have begun to set.
11. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
12. Do not vibrate Self-Consolidating Concrete (SCC).

E. Placing Concrete Slabs:

1. Place concrete continuously without interruption between predetermined construction and contraction joints in floors.
   a. Place slabs on grade by the long strip cast method. Refer to ACI 302.1R for recommended methods of placement.

2. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
3. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
4. Bring slab surfaces to correct level with a straightedge and strike off.
   a. Use highway straight edges, bullfloats or darbies to smooth surface free of humps or hollows.
   b. Do not disturb slab surfaces prior to beginning finishing operations.

5. Maintain reinforcing in proper position on chairs during concrete placement.
6. Do not place materials on slabs or impose loads during period of setting.

F. Placing Concrete on Steel Decks

1. Exercise care during concrete placement on steel decks to prevent concentrated loads or high pile-ups of concrete and to avoid impacts caused by dumping or dropping of concrete on steel decks.
2. Do not use buggies on unprotected areas of deck. If buggies are used to place concrete, furnish and install planked runways to protect deck from damage.

G. Placing Concrete at Construction Joints:

1. To secure full bond at construction joints, surfaces to receive concrete in a subsequent placement shall be left in a roughened state or intentionally roughened by raking while plastic or brushing and chipping immediately after removal.
2. Before new concrete is placed in contact, surfaces of hardened concrete already placed shall be thoroughly cleaned of foreign materials and laitance.
3. At hardened concrete at joints where no bonding agents are used, dampen concrete to achieve a saturated surface dry condition. Leave no standing water. Place and vibrate concrete (slump 7 inches (180mm) or greater) against horizontal joints. Place and vibrate flowing concrete (slump 8 to 10 inches (200 to 250mm)) while maintaining pressure against vertical joints by confinement.
4. At hardened concrete with joints not meeting conditions required for no bonding agents, apply appropriate specified bonding agent for conditions present including age and moisture per manufacturer's specifications. Place new concrete while the bonding agent is still tacky.

H. Floor Topping Slabs:

1. Place concrete topping slab to required lines and levels.
2. Minimum topping slab thickness is 2" (50mm).
3. Place dividers, edge strips and other items to be cast in place.
4. At all topping slabs, remove deleterious material before placing topping slab.
5. All topping slabs shall be bonded unless noted as unbonded on the drawings.
6. Bonded topping slabs should be placed directly against a properly prepared base slab. Proper preparation of the base slab consists of cleaning and removal of all deleterious material roughening the surface to a concrete surface profile of CSP5 or CSP6 and overnight prewetting of the newly

cleaned, exposed surface with no standing water present. The surface abrasion method should not cause micro cracking of the top of the base slab.

7. Immediately before placing the bonded topping slab, scrub an even, 1/16" to 1/8" layer of portland cement/sand/water bonding grout over the entire surface to receive the topping slab. Do no allow the bonding grout to dry to a whitish appearance before the topping slab is placed.
8. Where topping slab is noted on Drawings as unbonded the topping should be placed on bond breaker consisting of two sheets of plastic film.
9. Topping mix shall have a maximum water/cement ratio of 0.45.
10. Topping mix shall have a maximum shrinkage of 0.04% at 28 days. If the topping slab is to be exposed and polished, the maximum shrinkage shall be 0.02%.
11. The topping slab shall be moist cured for a minimum of 36 hours after placement.
12. Bonded topping slabs shall have contraction joints located to match any joints in the base slab. All topping slabs shall be jointed to eliminate restraint conditions such as re-entrant corners and to isolate the slab from columns, walls, etc. and to limit the maximum distance between joints to 15 feet (4570mm).

I. Cold-Weather Placement:

1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306R and as specified in this section.
2. When air temperature has fallen to or is expected to fall below 40°F (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C), and not more than 80°F (27°C), at point of placement.
3. Do not use frozen materials or materials containing ice or snow.
   a. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
4. Remove frost, snow and ice from forms, reinforcement and other embedments immediately prior to concrete placement.
5. Use only the specified non-corrosive accelerating admixture previously approved as part of the cold weather mixture. Addition of calcium chloride, salt, thiocyanates or admixtures containing more than 0.05 percent chloride ions is not permitted.
6. Freeze Resistant Concrete per ASTM C1622 and Chapter 9 of ACI 212.3R may be used if approved by SER. The contractor shall prepare a plan for placing, finishing and curing procedures that assure the specified hardened properties are achieved.

J. Hot-Weather Placement:

1. Hot weather is defined as air temperature which exceeds 90°F (32°C) or any combination of high temperature, low humidity and/or high wind velocity which causes a rate of evaporation in excess of 0.2 pounds per square feet per hour (1.0 kg/m² per hour) as determined by ACI 305R.
2. When hot weather conditions exist that would impair quality and strength of concrete, place concrete in compliance with ACI 305R and as specified in this section.
3. Cool ingredients before mixing to maintain concrete temperature at time of placement below **[95°F (35°C)].**
4. Mixing water may be chilled, or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
5. Use of liquid nitrogen to cool concrete is Contractor's option.
6. Fog spray forms, reinforcement, and subgrade just before pouring concrete.

7. When concrete placement will occur late in the day and reinforcing steel will be heated by the sun, cover reinforcing steel with water-soaked burlap so that steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
8. When concrete operations must be performed in direct sun, wind, high temperatures, low relative humidity, or other adverse placing conditions, the specified evaporation retarder shall be applied one or more times during the finishing operation to prevent plastic cracking.

3.6 CONCRETE FINISHES

A. General:

1. Comply with recommendations for concrete finishing established by ACI 302.1R and ACI 304R.
2. Comply with dimensional tolerance limitations given by ACI 117.
3. For shored floor or slab on grade construction: Floor flatness/floor levelness tolerance compliance testing is to be performed prior to the removal of shores and forms but not later than **[72]** hours of concrete placement by Testing Agency.
4. See architectural Drawings for locations of the various finishes listed below.
5. Comply with the specified overall SOF_F and SOF_L values listed below:
   a. The specified overall area shall be each individual floor.
   b. F_F/F_L shall be measured in accordance with ASTM E 1155.
   c. The specified minimum local values of MLF_F/MLF_L shall be 3/5 of the SOF_F/SOF_L values listed below.
   d. If an individual test section measures less than either of the specified minimum local MLF_F/ MLF_L numbers, that section may be rejected and remedial measures may be required as specified in CONCRETE SURFACE REPAIRS.
   e. If the composite value of the test surface measures less than either of the specified overall SOF_F/SOF_L numbers, then the entire slab may be rejected and remedial measures may be required.
   f. F_L numbers shall only apply to supported slabs if the tested with all of the original shoring in place, prior to shoring removal/reshoring.
   g. F_L numbers shall not apply to unshored slabs or shored slabs with camber.

B. Finish for monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile and other bonded applied cementitious finish flooring material, as indicated on architectural Drawings:

1. Scratch Finish.
   a. Finish surface to overall value of SOF_F=20 and SOF_L=15.
   b. Slope surfaces uniformly to drains where required.
   c. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

C. Finish for monolithic slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, sand-bed terrazzo as indicated on architectural Drawings:

1. Float Finish.
   a. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating.
   b. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both.

c. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units.
d. Finish surfaces to overall value of SOF_F=20 and SOF_L=15.
e. Cut down high spots and fill low spots.
f. Uniformly slope surfaces to drains.
g. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

D. Finishes for Pedestrian Sidewalks and Ramps, Exterior Platforms, Steps, as indicated on architectural Drawings:

1. Sidewalks and Curbs: Light-to-medium broom finish applied with fiber-bristle broom perpendicular to direction of main traffic route immediately after float finishing.
2. Ramps: Scored finish as applied perpendicular to direction of main traffic route immediately after float finishing.
3. Finish surface to overall value of SOF_F=20 and SOF_L=15.
4. Texture shall be approved by the Design Professionals from sample panels.

E. Finish for interior floor slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, paint or another thin film-finish coating system, as indicated on architectural Drawings:

1. Trowel Finish.
   a. After floating, begin first trowel-finish operation using a power-driven trowel.
   b. Begin final troweling when surface produces a ringing sound as trowel is moved over surface.
   c. The final hand-troweling operation shall result in a smooth surface, free of trowel marks, uniform in texture and appearance.
   d. Grind smooth any surface defects that would telegraph through applied floor covering system.

2. Finish surface to overall value of SOF_F=25 and SOF_L=20.
3. Floor Slopes: Where drains occur, slope floor slabs uniformly to drains, maintaining scheduled slab thickness.
4. Floor Edges at Expansion Joints: Tool edges minimum 3/8" (10mm).
5. Defects: Remove defects of sufficient magnitude to show through floor covering by grinding.
6. Floor Hardener: Use only where scheduled and in accordance with manufacturer's published instructions.
7. Dry Cement: Shall not be used during finishing.

F. Finish for thin set ceramic tile or thin set epoxy terrazzo, as indicated on architectural Drawings:

1. Trowel and Fine Broom Finish:
   a. Apply a trowel finish as specified.
   b. Immediately follow by slightly scarifying the surface with a fine broom.

2. Finish surface to overall value of SOF_F=35 and SOF_L=25.

G. Finishes for Parking Garage Deck, Ramps, Loading Docks:

1. Highway straight edge immediately after screeding concrete.
2. Finish surface to overall values of SOF_F=20 and SOF_L=15. SOF_L should not be tested for parking slabs that include inclined surfaces or planned changes in floor surface slope.

3. For Slabs Not Receiving Deck Coating: Medium broom finish with ridges not to exceed 1/8" (3mm) in height. Texture shall be as approved by the Design Professionals from sample panels.
4. For Slabs Scheduled to Receive Deck Coating: Smooth floated finish which must be verified with coating manufacturer before finishing the slab.
   a. Coordinate with deck coating specified in Division 7.

5. Auto Ramps: Rough texture applied perpendicular to direction of traffic. Texture shall be as approved by the Design Professionals from sample panels.

H. Finishes Equipment and Housekeeping Pads

1. Coordinate finish surface to meet equipment manufacturer requirements, if any, for flatness and levelness.

I. Tolerances at Slab Discontinuities

1. Within 2 ft (600mm) of slab boundaries, construction joints, isolation joints, block-outs, penetrations or other similar discontinuities, where required for travel paths, installation of finishes and partitions, or any other requirements indicated in the Contract Documents, the following equivalent straightedge tolerances shall apply:
   a. Specified local MLF_F = 12, use ¼" (6mm) over 4 ft (1200mm), no offset greater than 1/16" (2mm)
   b. Specified local MLF_F = 15, use 1/8" (3mm) over 4 ft (1200mm), no offset greater than 1/32" (0.8mm)

J. Dry Shake Finish:

1. Non-slip aggregate where indicated on Drawings.
2. Non-oxidizing metallic hardener on loading docks at a rate of 1.5 lbs. per sq. ft. (7.3 kg/m²) and in other locations so noted on the Drawings.
3. Mineral aggregate hardener at a rate of 1.2 lbs. per sq. ft. (5.8 kg/m²) where noted on the Drawings.
4. Final finish type, method and tolerance as applicable by location and use.
5. Dry shake finish will be applied only where scheduled and in accordance with the manufacturer's published instructions and the methods and procedures agreed upon at the pre-installation conference.

K. Rough Formed Finish:

1. Acceptable for formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated.
2. Concrete surface shall have texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4" (6mm) in height rubbed down or chipped off.

L. Architectural Concrete Finish:

1. Using self-consolidating concrete, provide smooth, uniform finish upon form removal with no patching, stoning or other form of repair except washing permitted unless otherwise noted for walls, columns and other surfaces exposed to view. The surface shall match the approved jobsite mock-up panel.

M. Smooth Formed Finish:

1. Required for formed concrete surfaces exposed to view, or scheduled to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system, as indicated on architectural Drawings:
2. Surface is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
3. Repair and patch tie holes and defects. Remove fins and other projections completely.

N. Smooth Rubbed Finish:

1. "Smooth Rubbed" finish shall consist of a finish free of fins, joint marks smoothed off, blemishes removed and surfaces left smooth and unmarred.
2. Provide smooth rubbed finish to scheduled concrete surfaces, as indicated on architectural Drawings, which have received smooth form finish treatment not later than one day after form removal.
3. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced.
    a. Do not apply cement grout other than that created by the rubbing process.

O. Grout-Cleaned Finish:

1. Provide grout-cleaned finish on scheduled concrete surfaces, as indicated on architectural Drawings, that have received smooth-formed finish treatment.
2. Combine one part Portland Cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint.
3. Blend standard Portland Cement and white Portland Cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
4. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes.
5. Remove excess grout by scraping and rubbing with clean burlap.
6. Keep surface damp by fog spray for at least 36 hours after rubbing.

P. Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.7 CURING AND PROTECTION

A. Normal Conditions:

1. Protect concrete from premature drying, excessive hot or cold temperature, and damage.
2. Concrete shall be kept continuously moist and above 50°F (10°C) for seven days (ASTM C 150 Type I cement) or for 10 days (ASTM C 150 Type II cement). High early strength concrete usage shall be maintained over 50°F (10°C) for three days.

3. Concrete and concrete patching materials shall be cured according to manufacturers published recommendations.
4. Begin curing as soon as free water has disappeared from concrete surface and finishing has been completed.
5. Curing Methods: Cure concrete by curing compound, moist curing, moisture-retaining cover curing, or by combining these methods, as specified. Under extreme hot/dry or windy/dry conditions, moist curing and/or moisture-retaining cover curing should be used.
    a. Curing compound is an acceptable form of curing if all of the following requirements are met:
        i. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). In accordance with all manufacturer's instructions.
        ii. Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions.
        iii. Recoat areas subjected to heavy rainfall within 3 hours after initial application.
        iv. Maintain continuity of coating and repair damage during curing period.
        v. Use curing and sealing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
        vi. Floors to receive covering shall be cleaned thoroughly using a power scrubber and industrial strength detergent.
        vii. Hand-brooming and sweeping is not sufficient.
        viii. Strippable curing compound may be used in lieu of a moist curing method when approved by the Design Professionals.
    b. Provide moist curing by the following methods:
        i. Keep concrete surface continuously wet by covering with water.
        ii. Use continuous water-fog spray.
        iii. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4" (100mm) lap over adjacent absorptive covers.
    c. Provide moisture-retaining cover curing as follows:
        i. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" (75mm) and sealed by waterproof tape or adhesive.
            1) Immediately repair any holes or tears during curing period using cover material and waterproof tape
6. Cure slabs on grade, concrete toppings, concrete pour strips, supported slabs, walls and columns, not subject to conditions of hot or cold weather concreting, in accordance with ACI 308.
7. Cure surfaces exposed to deicing salts, brackish water, etc., such as loading dock slabs, parking garage slabs and ramps in accordance with ACI 308 recommendations for moist curing.
8. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by leaving forms in place for the full curing period (equivalent to moist curing).
    a. If forms are removed prior to completion of full curing period, continue curing by methods specified above for Unformed Surfaces, as applicable.

B. Cold-Weather Protection:

1. When concrete is placed under conditions of cold weather concreting (defined as a period when the mean daily temperature drops below 40°F (4°C) for more than 3 successive days), take additional

precautions as specified in ACI 306R when placing, curing, monitoring and protecting the fresh concrete.

C. Hot-Weather Protection:

1. When concrete is placed under conditions of hot weather concreting, provide extra protection of the concrete against excessive placement temperatures and excessive drying throughout the placing and curing operations with an evaporation retarder.
   a. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

2. Hot weather curing is required if hot weather conditions occur within a 24-hour period after completion of concrete placement.

D. Floor surfaces, wherever indicated by weather conditions, shall be sprinkled during the interval between finishing operation and the start of curing to positively ensure against the possibility of surface drying.

3.8 CONCRETE REPAIRS

A. Perform patching and repairs in accordance with ACI 301.

B. Contractor shall submit patching and repair methods and materials for review by Design Professionals.

C. When complete, all patches and repairs shall match color and texture of adjoining surfaces.

D. At surfaces that are exposed to view, prepare test areas at inconspicuous locations for review by Design Professionals to verify repair color and texture match before proceeding with repair.

E. Apply all patching and repair materials in accordance with manufacturer’s specifications.

F. Repairing Cracks In Formed and Unformed Surfaces:

1. Contractor shall notify Design Professionals of all cracks wider than 0.02” (0.50mm) and all cracks wider than 0.01” (0.25mm) that occur in a group of at least three cracks within twelve inches (300mm), in concrete. If Design Professionals deem repairs necessary, Contractor shall be responsible for repairing all such cracks per Design Professionals recommendation at no expense to the Owner. Repairs will generally require one or more of the following: Epoxy Injection, Semi-Rigid Epoxy, Pressure Injected Foam Resin, Methyl Methacrylate and/or Sealant with joint routed and cleaned. See Concrete Repair Materials section of this Specification for acceptable products

G. Repairing Formed Surfaces

1. Immediately after stripping forms, patch all honeycombing, defective joints, voids, etc. before the concrete is thoroughly dry.
2. Remove all burrs, fins, and ridges before the concrete is thoroughly dry.
3. Remove stains from rust, grease and oils, from release agents, etc.
4. Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Design Professionals.

a. Surface defects, include color and texture irregularities, cracks as defined above, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
b. Chip away defective areas, honeycomb, rock pockets, voids over 1/4" (6mm) in any dimension and holes left by tie rods and bolts, down to solid concrete but in no case to a depth less than 1" (25mm) and saw-cut edges to prevent feather edging of fill material.

5. Repair concealed formed surfaces, where possible, containing defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
6. Clean out form tie holes and fill with dry pack mortar or precast cone plugs secured in place with bonding agent.
7. If honeycombing exposes reinforcement, chip to provide clear space at least 3/4" (20mm) wide all around steel to allow proper bond.

H. Repairing Unformed Surfaces:

1. High and Low areas in concrete surfaces which are in excess of specified tolerances shall be leveled or ground-smooth.
   a. Correct high areas by grinding after concrete has cured at least 14 days.
   b. Correct low areas by applying leveling material. Finish leveling material as specified in this section.

2. Repair surfaces containing defects that affect durability of concrete.
   a. Surface defects include crazing, cracks as defined above, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

3. Repair defective areas, except random cracks and single holes not exceeding 1" (25mm) in diameter, by cutting out and replacing with fresh concrete.
   a. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4" (20mm) clearance all around.

I. Filling In: Fill in holes and openings left in concrete for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place.

3.9 EVALUATION AND ACCEPTANCE OF CONCRETE

A. In accordance with ACI 301, except where otherwise specified.

B. If, at any time during construction, the concrete resulting from the approved mix design deviates from Specification requirements for any reason, such as lack of workability, or insufficient strength, the Contractor shall have his laboratory verify the deficiency and modify the mix design, until the specified concrete is obtained. Modified mix to be submitted for approval per Part 1 - SUBMITTALS.

3.10 CORRECTIVE MEASURES

A. Conflicts: The Contractor shall be solely responsible for errors of detailing, fabrication, and placement of reinforcement steel; placement of inserts and other embedded items; and the structural adequacy of all formwork.

B. Compensation for Additional Services: Should additional work by Design Professionals such as design, documentation, meetings and/or site visits be required which are necessitated by failure of the Contractor to perform the work in accordance with the Contract Documents either developing corrective actions or reviewing corrective actions developed by others, the Contractor is responsible for paying for additional work performed by the Design Professionals at their standard firm-wide billing rates plus out-of-pocket expenses incurred at cost + 10%. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.

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CONCRETE MIX DESIGN SUBMITTAL FORM

Project: _____

City: _____

General Contractor: _____

Concrete Contractor: _____

Concrete Strength: _____

Use/Location on Job: _____

Supplier's Mix Designation: _____

Design Mix Information **(Please check one):** *Refer to ACI 301 for requirements of data used to substantiate strength calculations.*

Field Experience (Based on Standard Deviation Analysis): _____

Trial Mixture Test Data: _____

Design Characteristics:

Density: _____ Pcf (kg/m3)

Strength: _____ Psi (MPa) (28 day)

Air: _____ % (specified)

Materials:	**Type/Source**	**Specific Gravity**	**Weight (lb)**	**Absolute Vol. (cu. ft.) (cu. m)**
Cement:				
Fly ash:				
Slag (GGBFS)				
Microsilica:				
Coarse Aggregate:				
Fine Aggregate:				
Water:				
Air:				
Other:				
TOTAL:				27.0 cu. ft. (1.0 m3)
Water/Cementitious Material Ratio (lbs. (kg) water / lbs. (kg) cementitious material) =				%

Admixtures:	Manufacturer	ASTM	Dosage (oz/cwt)
Water Reducer:			
Air Entraining Agent:			
High Range Water Reducer			
Non-corrosive Accelerator:			
Other:			

Slump before HRWR: _____ Inches (mm)

Slump after HRWR: _____ Inches (mm)

Standard Deviation Analysis (from experience records):

No. of Test Cylinders Evaluated: _____

Standard Deviation: _____

Required Average Strength f'cr

Average Strength by Tests

Equation Used (ACI Chapter 5)

(Refer to ACI 318 for increased deviation factor when less than 30 tests are available)

TRIAL MIXTURE TEST DATA

Compressive Strength:	Age (days)	Mix #1	Mix #2	Mix #3
	28 [56] [90]	psi (MPa)	psi (MPa)	psi (MPa)
	28 [56] [90]	psi (MPa)	psi (MPa)	psi (MPa)
	28 [56] [90]	psi (MPa)	psi (MPa)	psi (MPa)
	Average	psi (MPa)	psi (MPa)	psi (MPa)
Required Average Strength f'cr				
Average Strength by Tests				
Equation Used (ACI Chapter 5)				

REQUIRED ATTACHMENTS	***Please check***
Coarse Aggregate Gradation Report	
Fine Aggregate Gradation Report	
Fly Ash (or other Supplementary Cementitious Material) Certification	
Concrete Compressive Strength Data or Trial Mixture Test Data	
Admixture Compatibility certification letters	
Chloride Ion Content Certification	
Alkali Aggregate Reactivity Certification	
Shrinkage Test Reports	

SUBMITTED BY:

Name: _____

Address: _____

_____

Phone no.: _____

Main Plant Location: _____

Miles from Project: _____

Secondary Plant Location: _____

Miles from Project: _____

_____

Date: _____

Certification by Concrete Supplier:
Signature: _____

Print Name:

_____

PE License Number and Expiration Date (print or stamp) _____

Structural Substitution Request Form – to be completed by Contractor

Project:		
Date:		Substitution Request #
Requesting Contractor:		Pages Attached (including this form)

1. Description of Requested Substitution:

2. Related Drawings and Specification Sections:

3. Rationale or Benefit Anticipated:

4. Effect on Construction Schedule[1] (check one): ☐ NONE ☐ See Attached

5. Effect on Owner's Cost[2] attach data (check one): ☐ CREDIT TO OWNER ☐ EXTRA

6. Effect on Construction Documents[3] (design work anticipated): ☐ NONE ☐ See Attached

7. Requesting Contractor Agrees to Pay for Design Changes (check): ☐ YES ☐ NO ☐ NOT APPLICABLE

8. Effect on Other Trades[4]:

9. Effect of Substitution on Manufacturer's Warranty (check): ☐ NONE ☐ See Attachment

Signature[5]: Date:

Company:

General Contractor Signature[5]: Date:

Notes:

1. Contractor is responsible for means and methods and any problems that may arise from making the requested substitution.
2. This is **NOT A CHANGE ORDER FORM**. A separate form is required to adjust costs and/or schedules.
3. Contractor is responsible for any design impacts that may arise from this substitution, including redesign efforts.
4. Contractor is responsible for effects on other trades from this substitution;
   General Contractor must review and agree effects on other trades are fairly represented in items 4-9.
5. Signature by a person having authority to legally bind his/her company to the above terms. Otherwise this request is void
6. All items in form must be completed for substitution request to be considered.

Request Review Responses (completed by Architect and/or Engineer(s)):

ACCEPTED	ACCEPTED AS NOTED	REJECTED	INSUFFICIENT DATA TO SUPPORT REQUEST	ENGINEER / ARCH / MEP SIGNATURE	DATE

Engineer/Architect Comments:

END OF SECTION

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SECTION 03 3543 - POLISHED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes polished concrete pouring, placing, finishing and scoring.

1. Concrete for polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing must meet requirements specified in Section 03 3000 "Cast-in-Place Concrete."

B. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for concrete not designated as polished concrete.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Cast-in-place concrete installer.
   e. Polished concrete finishing installer.

2. Review cold- and hot-weather concreting procedures, curing procedures, construction joints, concrete repair procedures, concrete finishing, and protection of polished concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product requiring color selection.

C. Samples for Verification: For each exposed color.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material certificates.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years experience of polishing concrete with a record of successful installations.

B. Field Sample Panels: After approval of samples, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 8 by 8 feet minimum, to demonstrate the expected range of finish, color, and appearance variations.

1. Locate panels as indicated or, if not indicated, as directed by Architect.
2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
3. Demolish and remove field sample panels when directed.

1.6 FIELD CONDITIONS

A. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished.

1. Prohibit vehicle parking over concrete surfaces to be polished.
2. Prohibit pipe cutting operations over concrete surfaces to be polished.
3. Prohibit storage of any items over concrete surfaces to be polished for not less than 28 days after concrete placement.
4. Prohibit ferrous metals storage over concrete surfaces to be polished.
5. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces to be polished.
6. Protect from acids and acidic detergents contacting concrete surfaces to be polished.
7. Protect from painting activities over concrete surfaces to be polished.

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Stains and Floor Treatments: Obtain stain and liquid floor treatment for each polished concrete finish from a single source and the same manufacturer.

2.2 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ARDEX GmbH: PC 50.
b. CureCrete Concrete Solutions; RetroPlate.
c. L&M Construction Chemicals, Inc.; FGS Hardener Plus.
d. Prosoco; Consolideck First Cut with Densifier.
e. Vexcon; Certi-Shine Clear.

B. Polish Guard: Non-film forming, stain resistant, food resistant, chemical stain resistant, impregnating sealant designed to be used on concrete surfaces previously densified.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ARDEX GmbH.
   b. CureCrete Concrete Solutions.
   c. L&M Constuction Chemicals, Inc.
   d. Prosoco.
   e. Vexcon Chemicals Inc.

2.3 ACCESSORIES

A. Patching Compound: Compound composed of 40 percent portland cement, 45 percent limestone, and 15 percent vinyl acetate copolymer, when mixed with dust salvaged from grinding process forms a paste that hardens when surface imperfections are filled.

B. Grout Material: Clear modified silicate sealant, containing no pore clogging latex, when mixed with dust salvaged from grinding process forms a paste that reacts with calcium hydroxide in concrete that hardens when surface imperfections are filled.

C. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Alkalinity: Measure pH according to method indicated in ASTM F 710.

1. Acceptable Results: pH between 8 and 10.

C. Moisture Vapor Transmission Rate: Perform anhydrous calcium chloride test according to ASTM F 1869.

1. Acceptable Results: Not more than 5 pounds per 1000 square feet in 24 hours.

D. Relative Humidity: Perform relative humidity test using in situ probes according to ASTM F 2170.

1. Acceptable Results: Not more than 75 percent.

3.2 PREPARATION

A. Cleaning New Concrete Surfaces:

1. Prepare and clean concrete surfaces.
2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

3.3 POLISHING

A. Initial Grinding:

1. Use grinding equipment with metal bonded grinding pads.
2. Begin grinding in one direction using sufficient size grit pad.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 150 grit.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Vacuum floor using squeegee vacuum attachment after each pass.
6. Continue grinding until aggregate exposure matches approved field mock-ups.

B. Treating Surface Imperfections:

1. Mix patching compound and grout material with dust created by grinding operations to match color of adjacent concrete surface.
2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids.
3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

C. Penetrating Liquid Floor Treatments for Polished Concrete Finish Application: Apply undiluted to point of rejection, remove excess liquid, and allow to cure according to manufacturer's instructions.

D. Grout Grinding:

1. Use grinding equipment and appropriate grit grinding pads.
2. While applying fresh grout material prior to, grind concrete in direction perpendicular to initial grinding to remove scratches.
3. Vacuum floor using squeegee vacuum attachment after each pass.

E. Honing:

1. Use grinding equipment with resin bonded grinding pads.

2. Grind concrete in one direction starting with 50 grit pad and make as many sequential passes required to remove scratches, each pass perpendicular to previous pass, up to 400 grit pad reaching maximum refinement with each pass before proceeding to finer grit pads.
3. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.

F. Polishing:

1. Use polishing equipment with resin bonded polishing and burnishing pads.
2. Begin polishing in one direction starting with 800 grit pad.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 3000 grit.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.
6. Continue polishing until gloss appearance, as measured according to ASTM E 430, matches approved field mock-ups.

G. Polish Guard: Uniformly apply and remove excessive liquid according to manufacturer's instructions.

H. Final Polish: Using burnishing equipment and finest grit burnishing pads, burnish to uniform sheen matching approved mock-up.

I. Final Polished Concrete Floor Finish:

1. Class B – Fine Aggregate (Salt and Pepper) Finish: Remove not more than 1/16 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying fine aggregate with no, or small amount of, medium aggregate at random locations.
2. Level 2 – Medium Gloss Appearance:
   a. Procedure: Not less than 5 step process with full refinement of each diamond pad up to 800 grit resin bonded pad with one application of densifier.
   b. Gloss Reading: Not less than 55 according to ASTM E 430 before polish guard application.

3.4 SCHEDULE

A. Polished Concrete Floor (PC-1-): No stain, with penetrating floor treatment, and ground to Class B-salt and pepper finish.

1. Sheen: Level 2- medium gloss appearance.
2. Slip Resistance: The floor at substantial completion shall have a wet dynamic slip resistance of 0.50 or better based on ANSI A137.1-2012 Section 9.6: "Wet Dynamic Coefficient of Friction (DCOF)"

END OF SECTION 03 3543

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SECTION 03 4100
PRECAST STRUCTURAL CONCRETE: HOLLOW-CORE

PART 1 - GENERAL

1.1 GENERAL

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 - Specification sections, apply to work of this section.

1.2 SCOPE

A. This work includes the requirements for the design, fabrication, delivery, and installation of precast, reinforced and prestressed concrete Hollow-core slab units. The Work includes, but is not limited to

1. Concrete Materials
2. Hardware, Metal Inserts and Embedments
3. Formwork
4. Furnishing and placement of Prestressed and Bar Reinforcement
5. Mixing and placing Concrete
6. Surface Finish
7. Precast Quality Control, Inspection and Testing
8. Handling and transportation of Precast Components
9. Openings indicated on design Drawings
10. Prestressed and Bar Reinforcement Placement Drawings and Fabrication
11. Precast Erection
12. Grouting of Joints as indicated on design Drawings
13. Patching of Joints

1.3 RELATED WORK SPECIFIED IN OTHER SECTION

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 4500
Concrete Formwork	Section 03 1000
Concrete Reinforcement and Embedded Assemblies	Section 03 2000
Cast-In-Place Concrete	Section 03 3000
Concrete Masonry Units	Section 04 2200
Structural Steel	Section 05 1200
Caulking and Sealants	Section **[xxxxxx]**

1.4 CODES AND STANDARDS

A. Standards:

1. Prestressed Concrete Institute (PCI) - MNL 116 - Manual for Quality Control for Plants and Production of Structural Precast and Prestressed Concrete Products.
2. Prestressed Concrete Institute (PCI) - MNL 120 PCI Handbook – Precast and Prestressed Concrete; Precast/Prestressed Concrete INstitute.
3. Prestressed Concrete Institute (PCI) - MNL 123 – Design and Typical Details of Connections for Precast and Prestressed Concrete.
4. Prestressed Concrete Institute (PCI) - MNL 124 – Design for Fire Resistance of Precast Prestressed Concrete.
5. Prestressed Concrete Institute (PCI) - MNL 126 - Manual for The Design of Hollow Core Slabs.
6. PCI MNL 127 – Recommended Practice for Erection of Precast Concrete.
7. Prestressed Concrete Institute (PCI) - MNL 135 – Tolerance Manual For Precast and Prestressed Concrete Construction.
8. Prestressed Concrete Institute (CERT) – PCI Plant Certification; online at www.pci.org.
9. AASHTO M 251 – Specification for Plain and Laminated Elastomeric Bridge Bearings.
10. ACI 301 – Specifications for Structural Concrete and Commentary; American Concrete Institute.
11. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete.
12. ACI 309R – Guide for Consolidation of Concrete.
13. ACI 318 – Building Code Requirements for Structural Concrete and Commentary. American Concrete Institute International.
14. ASTM A36/A36M – Standard Specification for Carbon Structural Steel.
15. ASTM A185 – Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
16. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
17. ASTM A416/A416M – Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
18. ASTM A496 – Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
19. ASTM A615/A615M – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
20. ASTM C33 – Standard Specification for Concrete Aggregates.
21. ASTM C42 – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete. American Welding Society D1.1 – Structural Welding Code - Steel.
22. American Welding Society B2.1 – Specification for Welding Procedure and Performance Qualification; American Welding Society.
23. AWS D1.1/D1.1M 2010 – Structural Welding Code – Steel; American Welding Society.
24. AWS D1.4/D1.4M – Structural Welding Code - Reinforcing Steel; . American Welding Society.
25. IBC – International Building Code.

B. Definitions

1. See Section 03 3000.

1.5 PRECAST CONTRACTOR QUALIFICATIONS

A. Qualification Data: Submit for record qualification data (personnel and firm resumes, and project lists with references) for the Precast Fabricator (“Fabricator”), Contractor’s Engineer(s) and Precast Erector (“Erector”).

B. The design of all precast structural concrete is the responsibility of the contractor and shall be performed under the supervision of a Professional Engineer licensed in the state where the project is located and experienced in design of precast concrete structures.

C. The Professional Engineer responsible for the design of the precast structural concrete shall be responsible for the implementation of the design by reviewing the fabrication process to assure conformance with the design. The Professional Engineer at the end of the construction shall issue a written statement sealed and signed certifying the conformance with design. This certification must meet the standards of review of special inspection of IBC Section 1704 subsection 1705.4.2.1 exceptions. This certification is in addition to any quality assurance program for special inspection established by the Owner's Testing Agency.

D. The Fabricator shall have a minimum of 5 years successful experience in the fabrication of structural precast concrete units, similar to units required for this project. Fabricator must have sufficient production capacity to produce, transport, and deliver required units without causing delay in the Work.

E. Fabricator must be producer member of Precast Concrete Institute (PCI) and participate in its Plant Certification Program. The contractor must satisfy the standards of the PCI Plants Certification program and meet the requirements of IBC Section 1704, Special Inspections. Subsection 1704.2.1 permits exceptions if fabricators conformance to the Owner's inspection agencies approved quality control program. The basis of this conformance shall be the PCI Plant Certification and Quality Control Program.

F. The Erector shall have a minimum of 5 years successful experience in the erection of structural precast concrete units, similar to units required for this project.

1.6 SUBMITTALS

A. Required Submittals – Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested.

1. Concrete Mix Designs
2. Shop Drawings
3. Structural Design Calculations
4. Welder Certifications
5. Product Data
6. Hazardous Materials Notification

7. **Concrete Mix Designs**: Submit for action concrete mix designs as specified in Section 03 3000.
8. **Shop Drawings**: Submit for action of sizes and arrangement of components. Drawings should clearly indicate, but are not limited to:

    a) Layout, dimensions, sections through members and assemblies, joint and corner details, type and location of all inserts, reinforcing, prestressing tendons, strength of concrete, fastening and anchoring details, including clearances, and details of attachment to other work. Coordinate location of hanger tabs and devices for mechanical and electrical work and cutting of field openings. Indicate finishes, form types and other pertinent information.

    b) Erection schedules and sequences, assembly techniques, and marking of members.

c) Fabrication, bending and placement of concrete reinforcement. Include all reinforcement required and openings through concrete structures.
d) Dimensions, size and location of openings.
e) Quantities, location of stressing force of prestressing tendons.
f) Locations and details of connections, edge conditions and support conditions of precast units.
g) Inserts (including lifting and erection inserts), attachments, and embedments.
h) Anticipated cambers at time of erection.
i) Strength of concrete at prestressing and at time of erection.
j) Elongation for prestressing and at erection.
k) Caulked sealed joints.
l) Location, extent and reinforcing of any cast-in-place concrete on top of precast.
m) All areas of connections, embedments, etc. required to be sealed or caulked.

9. **Structural Design Calculations**: Submit structural design calculations for record sealed and signed by the contractor's **[Professional/Structural]** Engineer licensed in the state where the project is located. Each change of component configuration and design shall have its own set of calculations.

a) The precast structural elements will be designed to coordinate with the parameters set forth by the contract documents.
b) Precast structural elements shall be designed for all gravity wind and seismic loads indicated on the drawings.
c) In addition to the loads on the drawings, the design of the precast structural elements shall consider all stresses resulting from shipping, handling and erection, thermal loads, and other effects such as creep and shrinkage
d) Any changes required to the structural system, and/or architectural drawings to suit the proposed precast designs, if accepted by the Design Professionals and Owner, will be based on the contractor bearing all costs of such changes including the redesign costs of the Design Professionals
e) The design shall properly account for the concentration and distribution of loads due to openings.
f) Design component connections to accommodate building movement and thermal movement. Provide adjustment to accommodate misalignment of structure without unit distortion or damage. Design joints to accommodate the critical load combination to prevent internal stress, failure, deterioration or failure of weather seals or precast.
g) Design units to accommodate construction tolerances, deflection of building structural members and clearance of intended openings.
h) Precast structural concrete components shall be designed for the fire ratings indicated on the architectural drawings.

10. **Welder Certification**: Submit for record welder certificates as specified in Section 05 1200.
11. **Product data**: Submit for record only manufacturer's product data, including specifications and installation instructions clearly marked to indicate all technical information, including load tables where applicable, that specifies full compliance with requirements of this section and Contract Documents for each type of insert, accessory and product specified.
12. Hazardous Materials Notification: See Section 03 3000.

B. Submittal Process: See Section 03 3000.

C. SER Submittal Review: See Section 03 3000.

D. Substitution Request: See Section 03 3000.

E. Request for Information (RFI): See Section 03 3000.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions and Division 1, including the following:

1. Store all units in such a way to prevent contact with the ground.
2. Place stored units so that identification marks are discernible.
3. Separate stacked members by battens across full width of each slab unit.
4. Stack so that lifting devices are accessible and undamaged.
5. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.
6. Hollowcore slab units shall be lifted and supported during manufacturing, stockpiling, transporting, and erection operations only at the lifting or supporting point, or both, as shown on the shop drawings, and with approved lifting devices. Lifting inserts shall have a minimum safety factor or 4. Exterior lifting hardware shall have a minimum safety factor of 5.
7. Transportation, site handling, and erection shall be performed with acceptable equipment and methods, and by qualified personnel.
8. Exposed concrete units shall be adequately protected by padding or other means to prevent staining, chipping, or spalling of concrete

1.8 PRE-INSTALLATION CONFERENCE

A. At least twenty (20) working days prior to commencing the installation/erection of the precast the contractor shall hold a meeting to review the detailed requirements of the precast installation.

B. The contractor shall prepare an agenda and require responsible representatives of every party who is concerned with the precast installation to attend the conference, including but not limited to the following:

1. Precast Installer
2. Contractors installing associated work
3. Precast Fabricator
4. All Testing and Inspection Agencies
5. Design Professionals
6. Owner
7. Steel contractor as appropriate

C. Minutes of the meeting shall be recorded, typed and distributed by the contractor to all parties listed above with 5 working days of the meeting.

D. The minutes shall include a submission schedule for approval, discussion on sealants and formwork, compatibility of form coatings to be used that may affect bonding of sealants, and testing.

E. Notwithstanding any provision of the Specification, the Design Professionals shall not be responsible for and not have charge over any safety programs or precautions at the site of the project.

1.9 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. See Section 01 4500.

1.10 QUALITY CONTROL BY CONTRACTOR

A. See Section 01 4500 and 03 3000.

B. Concrete components shall be cast under controlled conditions. Forms shall be rigidly constructed, straight, square, true and designed for close control of dimensions and details.

C. All precast units shall be produced at a fabricating plant engaged primarily in manufacturing of similar units.

D. The finished product shall be lifted and/or supported at the points shown on the shop drawings or at the support points of the member when it is put into service.

E. Produce precast concrete units only at fabricating plant engaged primarily in manufacturing of similar units.

1.11 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. See Section 03 3000.

B. Design modifications may be made only as necessary to meet field conditions and to ensure proper fitting of the Work, and only as acceptable to the Design Professionals. Maintain general design concept shown without increasing or decreasing sizes of members or altering profiles and alignment shown. Submit for record complete design calculations and drawings prepared and stamped by a **[Professional/Structural]** Engineer licensed in the state where the project is located if design modifications are anticipated.

1.12 PERMITS AND WARRANTY

A. Permits: See Section 03 3000.

B. Warranty: See Section 03 3000. Failures include but are not limited to the following:

1. Abnormal deterioration, aging or weathering of the work, including spalling or evidence of visible warping or cracking.
2. Water leakage under conditions equivalent to, or less severe than those specified.
3. Structural failure due to pressures and forces under specified limits.
4. Sealant loss of adhesion, loss of cohesion, cracking or discoloration.
5. Collapse of thermal insulation or safing insulation.
6. Staining of precast panels by sealant or primer.

PART 2 - PRODUCTS

2.1 HOLLOW-CORE SLAB UNITS

A. Type: Precast, prestressed concrete units with open, hollow cores running the full length of the slab units.

B. Furnish units free of voids or honeycombs.

C. Provide standard finish to precast units, as specified herein.

D. Include cast-in weld plates where required.

E. Coordinate with other trades for installation of cast-in items.

F. Provide headers of cast-in-place concrete or structural steel shapes for openings larger than one slab unit width according to hollow-core slab unit fabricator's recommendations.

2.2 CONCRETE

A. Cement shall be Portland Cement as specified in Section 03 3000/Concrete.

B. Supplementary Cementitious Material shall be as specified in Section 03 3000/Concrete.

C. Concrete aggregates shall conform to ASTM C 33. The size of coarse aggregates in the concrete shall meet the spacing requirements of prestressing steel and/or reinforcing steels. The size of the coarse aggregate shall be no larger than 3/4" (size No. 67 per ASTM C 33).

D. Air Entrainment, water-cementitious materials, slump and admixtures shall be as specified in Section 03 3000.

E. Cement and aggregates shall be stored in such a manner as to prevent their deterioration or the intrusion of foreign matter. Any materials which have deteriorated or which have been contaminated shall not be used for concrete.

F. Use of calcium chloride, chloride ions or other salts is not permitted.

G. Concrete shall have a minimum 28-day compressive strength of 5000 psi, and a release strength of 3000 psi, or as specified on the drawings. Precast concrete shall have a resistance of not less than 3000 coulombs as per AASHTO-T277.

2.3 REINFORCEMENT

A. Materials, fabrication, etc., for reinforcing shall meet applicable ASTM standards as specified in Section 03 2000/Concrete Reinforcement and Embedded Assemblies.

B. Reinforcing Bars - ASTM A615, Grade 60.

C. Welded Plain Wire Fabric - ASTM A185.

D. Prestressing Strand – ASTM A 16, uncoated seven-wire stress-relieved strand, with a minimum tensile strength of 270,000 psi.

E. Weldable deformed steel – ASTM A706.

2.4 CONNECTION MATERIALS AND EMBEDDED ITEMS

A. Steel Shapes and Plates: ASTM A36 minimum.

B. Bolts and Studs: ASTM A307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened steel washers.

C. Welded Headed Studs: AWS D1.1, Type B headed studs, cold-finished carbon-steel bars.

D. Deformed-Steel Wire Bar Anchors: ASTM A496.

E. Welding Electrodes: Comply with AWS requirements.

F. Accessories: Provide clips, galvanized steel hangers, shims, and other accessories required to install precast concrete units.

G. [Sill Seal: Compressible glass fiber strips.]

H. Shop-Primed Finish: Prepare surfaces of interior steel items, except those with galvanized finish, or to be welded, or those surfaces to be embedded in concrete, according to requirements of SSPC-SP 3 and shop-apply primer according to SSPC-PA 1.

1. Primer: Fast-curing, lead- and chromate-free, VOC-conforming, universal modified-alkyd primer with good resistance to normal atmospheric corrosion.

2.5 BEARING PADS AND STRIPS

A. Provide bearing pads for precast concrete units as follows:

1. Bearing pads not susceptible to movement beyond that of flexure of the member shall be AASHTO grade 100% chloroprene (neoprene) or approved equal meeting the requirements of AASHTO standard specifications for Highway Bridges.
2. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 shore A durometer.
3. Random Oriented Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 shore A durometer. Shall support a compressive stress of 3000 psi with no cracking, splitting or delaminating in the internal portions of the pad. One specimen shall be tested for each 200 pads use in the project.
4. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric, bonded in elastomer. Surface hardness of 80 to 100 shore A durometer.
5. High-Density Plastic: Multi-monomer, nonleaching, plastic strip and support construction loads with no visible expansion.

2.6 FORMWORK

Provide forms and, where required, form facing materials of metal, plastic, wood, or other acceptable material that is non-reactive with concrete and will produce required finish surface.

2.7 CURING COMPOUND

A. The compound shall be in accordance with ACI 533 and compatible with “Hydrozo Enviroseal 40” sealing compound or equal. See Section 03 3000.

B. Sealing Compound: Sydrozo Enviroseal 40 sealing compound or approved equal. See Section 03 3000.

C. Dimensional Tolerances: Units having dimensions smaller or greater than required and not meeting tolerance limits may be subject to additional testing.

1. Precast units having dimensions greater than required will be rejected if the appearance or function of the structure is adversely affected or if larger dimensions interfere with other construction. Repair or remove and replace rejected units, as required, to meet construction conditions.

D. Defective Work: Precast concrete units that do not conform to requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that meet requirements.

PART 3 - EXECUTION

3.1 FABRICATION TOLERANCES

A. Listed below are generalized tolerances taken from the referenced standards

1. Overall dimension - The numeral greater of +/- 1/16" per 10 ft. or +/- 1/8" (PCI).
   a. Cross-sectional dimensional (ACI):
   b. Section less than 6", +/- 1/8".
2. Section over 6" and less than 18", +/- 3/16".
3. Squareness (PCI) - 1/8" in 6 ft. out of square as measured on the diagonal.
4. Deviation from specified camber (ACI) - Precast, 1/16" per 10 ft. of span; Prestressed, 1/8" per 10 ft. of span. Differential camber between adjacent units shall not exceed 3/8".
5. Deviation from straight line in long section (ACI) - Not more than 1/8" per 10 ft.
6. Warpage (PCI) - 1/8" per 6 ft. of length.
7. Variation in size and locations of sleeves and openings (ACI) - 1/4".
8. Location of anchors and inserts (PCI) - 3/8" off center line location shown on drawings.

B. Shop drawings shall explicitly show tolerances on major dimensions. Include length, width, thickness and diagonals. A note summarizing the other above mentioned tolerances shall be indicated on shop drawings.

3.2 FABRICATION AND PLACEMENT OF REINFORCEMENT

A. Formwork: Accurately construct forms, mortar-tight, and of sufficient strength to withstand pressure due to concrete placing operations, temperature changes and, when pretressed, pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shape, lines and dimensions indicated, within specified fabrication tolerances.

B. Unless forms for plant-manufactured prestressed concrete units are stripped prior to detensioning, design forms so that stresses are not induced in precast units due to deformation of concrete under prestress or to movement during detensioning.

C. Placing and supporting the reinforcing steel shall be in accordance with Concrete Reinforcing Steel Institute's "Recommended Practice for Placing Bar Supports Specifications and Nomenclature", and with applicable sections of ACI 318.

D. Reinforcement to be welded shall conform with AWS D1.4.

E. The spacing of prestressing strands at the ends of the component shall be the largest of the following:

1. The center to center distance of prestressing strands shall be not less than three times the strand diameter.
2. The clear spacing between strands shall not be less than 1-1/3 times the maximum size of coarse aggregates.

F. Pretensioning: Pretension tendons for precast, prestressed concrete either by single-strand tensioning method or multiple-strand tensioning method. Comply with PCI MNL-116 requirements.

G. Built-In Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect the position of the main reinforcement or placing of concrete. Do not relocate bearing plates in units, unless acceptable to Design Professionals.

H. Cast-in openings 6 inches in diameter (or larger) or 6 inches square (or larger) according to final shop drawings. Other smaller holes may be field cut by trades requiring them, as acceptable to Design Professionals and provided the smaller openings do not conflict with prestressed reinforcement. All field openings must be located at least 2 inches from prestressed reinforcement. Should spalling occur, it shall be repaired by the trade performing the drilling.

I. The concrete cover shall be as shown on the drawings or as per Chapter 7 of ACI 318.

J. The surface condition of all reinforcement shall be clean and free of oil and substances harmful to bond. Special care shall be exercised with prestressing strands.

3.3 CONCRETE PLACEMENT

A. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast units. Comply with requirements of ACI 304R for measuring, mixing, transporting, and placing concrete.

B. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with ACI 309R.

3.4 CURING

A. The slab must be cured by either a continuous moist curing method approved by the Design Professionals or by using curing compound.

B. Wet cure shall be by continuous fog spray or immersion in water. Do not use curing compounds on surfaces to be wet cured.

3.5 PRESTRESSING STEEL

Prestressing steel shall be detensioned so that force in the prestressing steel shall be transferred to the concrete by releasing all strands simultaneously or by cutting individual strands. If the force in the strand is transferred individually, a sequence release and corresponding calculations prepared by the contractor's Professional Engineer shall be submitted for record to avoid subjecting the member to damaging stresses.

3.6 FINISH

A. Refer to architectural drawings for finish requirements.

B. Component surfaces shall be formed and texture as shown on the architectural drawings.

C. Standard underside

1. Resulting from casting against approved forms using good industry practice in cleaning of forms, design of concrete mix, placing and curing.
2. Small surface holes caused by air bubbles, normal color variations, normal form joint marks and minor chips and spalls shall be tolerated, but no major or unsightly imperfections, honeycomb, or other defects will be permitted.

D. Standard top

1. Finish unformed surfaces by trowel, unless otherwise indicated. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.
   a. Apply scratch finish to precast concrete units that will receive concrete topping after installation. Following initial strike-off, transversely scarify surface to provide ridges approximately 1/4 inch deep.

E. Blockouts shall be removed prior to shipment.

F. Inserts shall be free of contaminants and burrs.

3.7 ERECTION

A. All precast units shall be erected level, plumb, square and true so that no cumulative dimensional errors occur.

B. Install precast units with camber upward.

C. Install bearing pads and sill seal at bearing ends of planks as indicated.

D. As erection progresses, align and maintain uniform horizontal and end joints.

E. Adjust differential camber/elevation between precast members to tolerance before final attachment and grouting.

F. Grout longitudinal keys as indicated and tape seal underside of plank joints to prevent grout leakage.

G. The erector shall be responsible for any chipping, spalling, cracking or other damage to the units after delivery to the job site and until installation is completed.

H. The erector shall be responsible for damage to work and materials of other trades.

I. Shore and brace precast concrete units to maintain location, stability, and alignment until permanent connections are installed.

J. Bearing Pads: Install bearing pads as precast concrete units are being erected. Set pads on true, level, and uniform bearing surfaces and maintain in correct position until precast units are placed.

K. Alignment: Members shall be properly aligned and leveled. Variations between adjacent members shall be reasonably leveled out by jacking, loading, or any other feasible method as recommended by the manufacturer and accepted by the Design Professionals.

L. Field Welding:

1. Perform welding in compliance with AWS D1.1 and D1.4.
2. Protect units from damage by field welding operations and provide non-combustible shields as required.
3. Remove all lifting loops and touch-up paint all galvanized field welded connections as specified.
4. Repair damaged metal surfaces by cleaning and applying a coat of liquid galvanizing repair compound to galvanized surfaces and primer compatible with painted surfaces.

M. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed units, unless otherwise acceptable to Design Professionals.

3.8 ERECTION TOLERANCES

A. Prior to the erection of the precast components, all configurations, shape and top elevations of support points for the precast components shall be surveyed and verified. In case of conflicts, immediately notify the Design Professional prior to commencing the erection of the precast components.

B. Tolerances for Location of Precast Units - Fabricate and erect precast units so that joints between panels meet the following:

1. Face width of joints - plus or minus 3/16".
2. Joint taper - 1/40" per foot length, with maximum length of tapering in one direction of 10'.
3. Step in face - 1/4".

4. Jog in alignment of edge - 1/4".
5. Alignment for exterior panels is outside face.
6. Variation from plumb - plus or minus 1/2" in any 40' run.
7. Variation from level - plus or minus 1/2" in any 40' run.
8. Differential camber of adjacent pieces after erection under 1/4" for precast tees in drivelanes or pedestrian path and 3/8" elsewhere.

3.9 GROUTING

A. Grout open spaces at keyways, connections, and joints as indicated or required except for items grouted by other trades.

B. Mix non-shrink grout with sufficient water to cause it to flow under its own weight. See Section 03 3000.

C. Place fluid grout from one side and puddle for complete filling of voids; do not remove dams or forms until grout attains initial set. Finish exposed surfaces smooth and cure with damp burlap at least 3 days.

3.10 PATCHING

Patch and feather all joints to the satisfaction of the Design Professionals. First patch, approved by Design Professionals, will be considered standard of quality for subsequent patching. Proposed patching procedure shall be submitted to the Design Professionals for review.

3.11 CORRECTIVE MEASURES

A. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in Part 3 – CORRECTIVE MEASURES section of Specification 03 3000.

END OF SECTION

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SECTION 04 2000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units. (also refer to section 04 2200 for additional structural requirements)
   a. Decorative Concrete Masonry Units (DCMU) (Ground face interior)
   b. Pre-Faced Concrete Masonry Units (PFCMU) (Glazed face exterior)
2. Brick.
3. Mortar and grout materials.
4. Reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Accessories.
8. Mortar and grout mixes.

B. Products Installed but not Furnished under This Section:

1. Cast-stone trim in unit masonry.
2. Steel lintels in unit masonry.
3. Steel shelf angles for supporting unit masonry.
4. Cavity wall insulation adhered to masonry backup.

C. Related Requirements:

1. Section 04 2200 “Concrete Masonry Units” for additional structural requirements.
2. Section 05 1200 "Structural Steel" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
3. Section 07 1900 "Water Repellents" for water repellents applied to unit masonry assemblies.
4. Section 07 2100 "Thermal Insulation" for parapet wall insulation.
5. Section 07 2119 “Foamed-in-Place Insulation” for cavity wall insulation.
6. Section 07 6200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R. Indicate elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Weep/cavity vents.

D. Samples for Verification: For each type and color of the following:

1. Decorative CMUs.
2. Pre-faced CMUs.
3. Clay face brick, in the form of straps of five or more bricks.
4. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.

1.5 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Material Certificates: For each type of the following:

1. Masonry units.
   a. Include data on material properties.
   b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
   c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.
8. Anchors, ties, and metal accessories.

C. Qualification Statements: For testing agency.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients. Provide one of the following:

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

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

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Installers: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.
2. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.

1.7 MOCKUPS

A. Sample Panel Mockups: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 4000 "Quality Requirements" for mockups.

1. Build sample panels for each type of exposed unit masonry construction and typical exterior wall in sizes approximately 60 inches long by 48 inches high by full thickness.
2. Clean one-half of exposed faces of panels with masonry cleaner indicated.
3. Protect approved sample panels from the elements with weather-resistant membrane.
4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Architect specifically approves such deviations in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform or concentrated loads for at least three days after building masonry walls, pilasters or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain exposed masonry units from single source.

B. For cementitious mortar components, obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. Concrete masonry shall have the minimum compressive strength f'm as indicated in the Structural Drawings.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 ft. vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, use the equivalent thickness method for masonry units in accordance with ACI 216.1 or.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exterior exposed units.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, will show no visible water or leaks on the back of test specimen.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) ACM Chemistries;
      2) Euclid Chemical Company (The); an RPM company; Eucon Blocktite.

3) GCP Applied Technologies Inc.;
4) Master Builders Solutions;
5) Moxie International;

C. CMUs: ASTM C90, normal weight for below grade applications and normal weight for above grade applications, unless indicated otherwise.

1. For strength requirements refer to Structural Drawings.
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

D. Decorative CMUs (DCMU): ASTM C90, medium weight.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3050 psi.
2. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph above.
3. Pattern and Texture: Standard pattern, ground-face finish. Match Architect's samples.
4. Colors: Consumers Concrete, Perma Grind, Gray Hill with applied surface finish. Match Architect's Sample..
5. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.

E. Pre-faced CMUs (PFCMU): ASTM C90, lightweight solid units, with manufacturer's standard smooth resinous facing complying with ASTM C744. Exterior use – smooth, satin finish, conforming to ASTM C 744, ASTM C 67, paragraph 8 (freeze-thaw) and Thermal Shock Test B100JL, 24P.

1. Spectra-Glaze II Plus, with Block Rite System for block and mortar
2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3050 psi.
3. Size: Manufactured to dimensions specified in "CMUs" Paragraph above but with pre-faced surfaces having 1/16-inch- wide returns of facing to create 1/4-inch- wide mortar joints with modular coursing.
4. Colors and Patterns: Match Architect's samples.:
   a. PFCMU 1: S-17 Deep Astra Blue. 15.75 inch long x 7.75 inch high x 3.75 inch deep. Stack bond field, Soldier course under window sills.
   b. PFCMU 2: S-16 Light Kingston Blue. 15.75 inch long x 7.75 inch high x 3.75 inch deep. Stack bond.
   c. PFCMU 3: S-27 Deep Olive Green. 15.75 inch long x 7.75 inch high x 3.75 inch deep. Stack bond.
   d. PFCMU 4: S-43 Deep Pumpkin 15.75 inch long x 7.75 inch high x 3.75 inch deep. Stack bond.
   e. PFCMU 5: S-35 Deep Honey. 15.75 inch long x 7.75 inch high x 3.75 inch deep. Stack bond.

5.

2.5 LINTELS

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

B. Offset Angle Supports: Steel plate brackets anchored to structure, allowing continuous insulation behind shelf angle supporting veneer. Component and anchor size and spacing engineered by manufacturer.

1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
   a. FERO Corporation
   b. Halfen USA, Inc.
   c. Hohmann & Barnard, Inc.

2. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304.

2.6 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C216, Grade SW, Type FBX.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Acme Brick Company.
   b. Belden Brick Company (The). Basis of Design
   c. Boral Bricks, Inc; Boral Limited.
   d. Bowerston Shale Company
   e. Endicott Clay Products Co.
   f. General Shale Brick, Inc.

2. Central Elementary Products: Subject to compliance with requirements, provide the following:
   a. Central Brick 1: Color: Indian Full Range Course Velour. FBS Belden Brick. Modular 7.625 inch long x 2.25 inch high x 3.625 inch deep. Running Bond. Soldier course under 3 foot 4 inch high window sills.
   b. Central Brick 2: A blend of 3 brick:
      1) 80 % Dutch Gray Velour FBX
      2) 20 % Sea Gray Velour FBX
      3) 10% 8531 Velour FBX

4) 'Brick 2' colors listed above are Belden Modular 7.625 inch long x 2.25 inch high x 3.625 inch deep. Running Bond. Soldier course under 3 foot 4 inch high window sills.

c. Central Brick 3: Color: Anchor Gray Velour, FBX . Belden Brick, Modular, 7.625 inch long x 2.25 inch high x 3.625 inch deep, Running Bond

3. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 6600 psi.
4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M.
5. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
6. Size (Actual Dimensions): 3-5/8 inches deep by 2-1/4 inches high by 7-5/8 inches long. Unless noted otherwise.
7. Application: Use where brick is exposed unless otherwise indicated.

2.7 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D.

E. Mortar Cement: ASTM C1329/C1329M.

1. Lafarge North America, Inc.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Davis Colors.
   b. Euclid Chemical Company (The); an RPM company.
   c. Lanxess Corporation.
   d. Solomon Colors Inc.

G. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1) Argos USA, LLC
   2) Holcim (US) Inc.
   3) Lehigh Hanson, HeidelbergCement Group

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments do not exceed 10 percent of portland cement by weight.
4. Pigments do not exceed 5 percent of mortar cement by weight.

H. Preblended Dry Mortar Mix: Packaged blend made from portland cement and hydrated lime, sand, mortar pigments, water repellents, and admixtures and complying with ASTM C1714/C1714M.

I. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

J. Aggregate for Grout: ASTM C404.

K. For Pre-Faced CMU (PFCMU): Epoxy Pointing Mortar: ASTM C395, epoxy-resin-based material formulated for use as pointing mortar for glazed or pre-faced masonry units (and approved for use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

1. Basis of Design: Laticrete MVIS Two Part Epoxy Pointing Mortar

L. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Euclid Chemical Company (The); an RPM company.
   b. GCP Applied Technologies Inc.

M. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. ACM Chemistries;.
   b. Euclid Chemical Company (The); an RPM company
   c. GCP Applied Technologies Inc.;
   d. Master Builders Solutions;

N. Water: Potable.

2.8 REINFORCEMENT

A. Reinforcing Bars:

1. Horizontal and vertical reinforcement bars shall comply with requirements of Section 03 2000

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. Refer to Section 04 2200.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: As indicated on Structural Drawings diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Wire Size for Veneer Ties: 0.187-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 ft., with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

E. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Walls Without Cavities Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus two side rods at each wythe of masonry 4 inches wide or less.
2. Walls With Cavities: Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.9 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- thick steel sheet, galvanized after fabrication.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire.

E. Partition Top Anchors: Refer to Section 04 2200.

F. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0785-inch- thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.187-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. Masonry-Veneer Anchors; Double-Pintle Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting horizontal leg with slots for vertical legs of double pintle wire tie.
    a. Products: Subject to compliance with requirements, provide one of the following:
        1) Heckmann Building Products, Inc.;
        2) Hohmann & Barnard, Inc; HB-213.HB-282
        3) Quality Steel and Wire LLC;
        4) Wire-Bond; RJ-711 (#2401).

5. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours in accordance with ASTM B117.

2.10 EMBEDDED FLASHING

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
2. Zinc Sheet: Zinc, 99 percent pure, alloyed with 0.08 to 1.00 percent copper, 0.06 to 0.20 percent titanium, and up to 0.015 percent aluminum; with manufacturer's standard factory-applied, flexible, protective back coating.
    a. Products: Subject to compliance with requirements, provide one of the following:
        1) Contrarian Metal Resources; Alloy 710 Zinc.

2) Jarden Zinc Products; Solid Zinc Strip.
3) Rheinzink America Inc.; RHEINZINK.
4) Umicore Building Products USA, Inc.; VM ZINC series.

b. Install Zinc above at all locations of cast stone

3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 ft.. Provide splice plates at joints of formed, smooth metal flashing.
4. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
5. Fabricate metal drip edges from stainless steel, except above cast stone provide zinc. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

B. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Copper-Fabric Flashing: 3 oz./sq. ft. copper sheet bonded between two layers of glass-fiber cloth.
   a. Manufacturers: Subject to compliance with requirements, provide products by the following:
      1) Advanced Building Products Inc.
      2) Hohmann & Barnard, Inc.
      3) STS Coatings, Inc.
      4) Wire-Bond.
      5) York Manufacturing, Inc., Flash-Vent Copper, Basis of Design

2. Self-Adhering, Stainless Steel Fabric Flashing: Composite, flashing product consisting of 2 mil of Type 304 stainless steel sheet, bonded to a layer of polymeric fabric with a permanent, clear adhesive, to produce an overall thickness of 10 mil.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Hohmann & Barnard, Inc.; Mighty-Flash SA
      2) VaproShield LLC: VaproThru-Wall Flashing SA
      3) GE Silicones, Inc.: GE Elemax SS Flashing
      4) Wire-Bond, Bond-n-Flash S.A.
      5) York Manufacturing, Inc; York 304 SA SS
   b. Provide 20 year material warranty

C. Application: Provide metal flashing exterior drip edge termination with flexible flashing through wall.

1. At locations within 12 inches of grade, omit metal drip edge, extend flexible flashing beyond exterior face of wall and cut off flush with face of wall after masonry wall construction is completed.
2. At locations 12 inches to 72 inches above grade, smooth all sharp edges and corners to avoid injury.

D. Application: Use the following above all cast stone:

1. Provide flexible flashing with zinc drip edge or flexible flashing over zinc sheet with drip edge.

E. Drainage Plane Flashing: Contractors Option in lieu of providing materials separately. Fabricate from stainless steel and drainage membrane to shapes indicated, including weep tabs, termination bar, and drip edge. Provide flashing materials as follows:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Mortar Net Solutions;
b. STS Coatings, Inc.;

2. Stainless Steel: ASTM A240/A240M or ASTM A666,, 2 mil stainless steel sheet, bonded to a layer of polymeric fabric with a permanent, clear adhesive, to produce an overall thickness of 10 mil (0.25 mm).
3. Fabricate continuous flashings in sections 60 inches long, minimum.
4. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

F. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C920, chemically curingsilicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

G. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

H. Termination Bars for Flexible Flashing, Flanged: Stainless steel sheet 0.019 inch by 1-1/2 inches with a 3/8-inch flange at top.

2.11 FERO FAST BRACKET SYSTEM

A. FAST Standard Brackets, Rectangular Washers, Shim Rods, and Shim Plates for support of shelf angles.

1. All components manufactured by FERO Corporation, Edmonton, AB.
2. FAST Brackets to not exceed maximum spacings listed in FERO published load table and technical information and as indicated on the drawings.
3. FAST Bracket depth to fill wall cavity or as shown in construction documents.
4. FAST Bracket height to meet anchor to shelf and distance.
5. FERO shim plates to be used for meeting construction tolerances.
6. Installer to install FAST Bracket system in compliance with FERO published technical
7. documentation.
8. All components to be hot dipped galvanized after fabrication to meet the requirements of ASTM
9. A123 and CSA A370-14.

2.12 ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated. Minimum durometer hardness of 80.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

D. Weep/Cavity Vents: Use one of the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Advanced Building Products Inc.; Mortar Maze Weep Vent.
      2) Heckmann Building Products, Inc
      3) Hohmann & Barnard, Inc; QV Quadro-Vent.
      4) Mortar Net Solutions
      5) Wire-Bond; Cell Vent (#3601).

2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) CavClear; a division of Archovations, Inc.;
      2) Hohmann & Barnard, Inc;
      3) Keene Building Products; Driwall Weep Vents 025.
      4) Mortar Net Solutions; Mortar Net Weep Vents.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Mortar Deflector: Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches that prevent clogging with mortar droppings.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Advanced Building Products Inc.; Mortar Break DT.
      2) Hohmann & Barnard, Inc; Mortar Trap.
      3) Keene Building Products;
      4) Mortar Net Solutions; Mortar Net with Insect Barrier.
      5) Illinois Products Corporation; Mortar Grab
      6) Wire-Bond; Cavity Net DT.
      7) York Manufacturing, Inc; Weep-Net.

2. Rainscreen Drainage Mat: Sheets or strips not less than full depth of cavity thick and installed to full height of cavity, to prevent weep holes from clogging with mortar.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Advanced Building Products Inc.; Mortairvent CW.
      2) CavClear; a division of Archovations, Inc.;
      3) Keene Building Products;
      4) Mortar Net Solutions;
      5) Wire-Bond;.

F. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without

discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Diedrich Technologies, Inc.; a Hohmann & Barnard company;.
   b. EaCo Chem, Inc.;
   c. PROSOCO, Inc; Sure Klean® 600, Vana Trol

2.13 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 or mortar cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, 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, use Type S.
2. For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments do not exceed 10 percent of portland cement by weight.
2. Pigments do not exceed 5 percent of mortar cement by weight.
3. Mix to match Architect's sample.
4. Application: Use pigmented mortar for exposed mortar joints with the following units:
   a. Decorative CMUs
   b. Pre-faced CMUs
   c. Clay face brick.
   d. Cast stone trim units

E. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1.
3. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., 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 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., 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 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around anchors, Space anchors 48 inches o.c. unless otherwise indicated.
3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 8443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. With webs fully bedded in mortar in all courses of fire rated walls, including contiguous piers, columns and pilasters.
5. With webs fully bedded in mortar in all courses of walls forming mechanical shafts, including but not necessarily limited to, plumbing shafts, supply and return air shafts not containing fabricated ducts.
6. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
7. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

1. Provide raked joints for application of sealant in joints in sills, coping, and similar items.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 COMPOSITE MASONRY

A. Bond wythes of composite masonry together as follows:

1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

B. Bond wythes of composite masonry together using bonding system indicated on Drawings.

C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.

1. Provide continuity with masonry-joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.

E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are indicated at juncture, bond walls together as follows:

1. Provide continuity with masonry-joint reinforcement by using prefabricated T-shaped units.

3.7 CAVITY WALLS

A. Bond wythes of cavity walls together as follows:

1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Installing Cavity Wall Insulation: Spray adhesive on cavity side of back-up in accordance with insulation manufacturer's written instructions and recommendations. Extend to adjacent materials to provide a complete installation without gaps.

D. Thickness: 3 inches unless indicated otherwise.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.8 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.

B. Provide not less than 2 inches of airspace between back of masonry veneer and face of insulation.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.9 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.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.10 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.

3.11 CONTROL AND EXPANSION JOINTS

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

B. Form control joints in concrete masonry as follows:

1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Form expansion joints in brick as follows:

1. Build in compressible joint fillers where indicated.

D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 9200 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.12 LINTELS

A. Install steel lintels where indicated.

B. Provide concrete or masonry lintels where indicated and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are indicated without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.13 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and secure top of flashing to the inner wythe with termination bar and sealant.
3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; and secure top of flashing to the inner wythe with termination bar and sealant.

4. At lintels and shelf angles, extend flashing 6 inches minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum, to edge of next full unit and turn ends up not less than 2 inches to form end dams.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install reglets and nailers for flashing and other related construction where they are indicated to be built into masonry.

D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Accessories" Article.

F. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form cavity vents.

3.14 REINFORCED UNIT MASONRY

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

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

B. Placing Reinforcement: Comply with requirements in TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

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

3.15 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. 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 will be at Contractor's expense.

B. Inspections: Special inspections in accordance with [TMS 402/ACI 530/ASCE 5 and TMS 602/ASCE 6.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

H. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

3.16 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic masonry cleaner applied according to manufacturer's written instructions.
8. Clean cast stone trim to comply with cast stone manufacturer's written instructions.

3.17 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. 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. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 2000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. 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 2000

SECTION 04 2200
Concrete Masonry Units

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to requirements of Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections.

1.2 SCOPE

Provide all labor, materials, equipment, services and transportation required to complete all concrete masonry unit work as shown on Drawings, as specified herein, and as required by the job conditions.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 4500
Concrete Reinforcement and Embedded Assemblies	Section 03 2000
Cast-In-Place Concrete	Section 03 3000
Structural Steel	Section 05 1200
Steel Joists	Section 05 2000
Thermal and Moisture Protection	Division 7

1.4 CODES AND STANDARDS

A. Building Code: Concrete masonry unit work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. TMS 402/ACI 530/ASCE 5 – Building Code Requirements for Masonry Structures (TMS 402)
2. TMS 602/ACI 530.1/ASCE 6 – Specification for Masonry Structures (TMS 602)
3. American Society for Testing and Materials "ASTM Standards in Building Codes", various standards as referenced herein.

C. Definitions:

1. See Section 03 3000 or 05 1200.
2. CMU: Concrete Masonry Unit(s)

1.5 CONTRACTOR QUALIFICATIONS

A. The work of this section shall be performed by a company specializing in the type of concrete masonry unit work required for this Project, with a minimum of 10 years of documented, successful, experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

B. Grouting and Reinforcement: All masonry grouting and reinforcement work shall be performed by masonry craftworkers who have successfully completed the International Masonry Institute training course for Grouting and Reinforced Masonry Construction or equal.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested. Reproduction of Structural Drawings for shop drawings is not permitted.

1. Submittal Schedule
2. Shop Drawings
3. Mix Designs and Test Results
4. Statement of Compressive Strength
5. Construction Procedures
6. Material Certificates
7. Hot and Cold Weather Procedures
8. Product Data
9. Comprehensive Layout Drawings
10. Structural Repairs
11. Hazardous Materials Notification

12. **Submittal Schedule**: See Section 03 3000.
13. **Shop Drawings:** Submit for action shop drawings for masonry that shall clearly indicate, but not be limited to:
    - **a.** Reinforcement consistent with the Shop Drawings submittal requirements of Section 03 2000.
    - **b.** Concrete Masonry Units including sizes, profiles, coursing, and locations of special shapes.
    - **c.** Contraction (Control) joint type, details, and locations.

14. **Mix Designs and Test Results**: Submit for action data as required to verify the specified values of f'm as determined by the Unit Strength Method per TMS 420. This would include mortar and grout mix designs/types and test results for each concrete masonry unit strength required for the Project at least thirty (30) days before CMU installation begins.
    - a. Mix designs and test results shall be prepared or reviewed by an approved independent Testing Agency retained by the Contractor and shall be coordinated with design requirements and Contract Documents.
    - b. Before submitting to Testing Agency, submit complete mix design data for each separate mortar and grout mix to be used on the Project in a single submittal.
    - c. Mix materials shall be from the same production facility that will be used for this Project.
    - d. Mortar mix designs for each mortar type indicated on Structural Drawings shall include:
        - i. Mortar type
        - ii. Aggregate type and gradation

iii. Locations on the Project where each mix design is to be used corresponding to Structural General Notes on the Drawings.
iv. Type of cement used.
v. **[Type and proportions of ingredients in accordance with the proportion specification of ASTM C270. OR Mortar tests performed in accordance with the property specification of ASTM C270.]**
vi. [Pigment color, type and quantity]

e. Grout mix designs for each grout strength indicated on Structural Drawings shall include the following. Cast-in-place concrete mixes are not acceptable substitutes for grout and will be rejected:
i. 28-day compressive strength as indicated on Structural Drawings.
ii. Aggregate type and gradation
iii. Locations on the Project where each mix design is to be used corresponding to Structural General Notes on the Drawings.
iv. [Type and proportions as determined by volume in accordance with ASTM C476. OR Type and proportions as determined by compressive strength tests performed in accordance with ASTM C1019. OR Compressive strength tests performed in accordance with ASTM C1019 and slump flow and Visual Stability Index (VSI) as determined by ASTM C1611.]

15. **Statement of Compressive Strength:** Submit for record for each combination of masonry unit type and mortar type a statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined in accordance with TMS 602.
16. **Construction Procedures:** Submit for record procedures for construction of masonry walls. Procedures shall include high lift or low lift grouting as applicable to the Project covering maximum planned lift and pour heights.
17. **Material Certificates:** Submit for record material certificates signed by the material supplier that the masonry units, mortar, grout, admixtures, reinforcement, joint material, anchors, ties, and metal accessories comply with specification requirements and are compatible with each other.
18. **Hot and Cold Weather Procedures**: Submit for record written procedures for placement of CMU in hot and cold weather conditions. Hot and Cold weather are as defined in the CMU Placement section of this Specification.
19. **Product Data**: Submit for action product data clearly marked to indicate locations to be used and all technical information which specifies full compliance with this section and Contract Documents, including published application instructions, product characteristics, compatibility, and limitations for each of the following:
a. Concrete masonry units: Submit the following for each type of masonry unit indicated in the Structural Drawings:
i. Average net-area compressive strength of units including material test reports substantiating compliance with the contract documents.
ii. Unit dimensions
iii. Web and face shell thickness
iv. Density
v. Color
vi. Texture
b. Mortar materials
c. Grout materials
d. Each material and grade of reinforcement
e. Each type and size of metal accessories

f. Pigments

20. **Comprehensive Layout Drawings:** Submit for action comprehensive layout drawings (a single drawing per area/element):
    a. Drawings shall consolidate the work of all trades and shall be coordinated by the Contractor.
    b. Show walls in elevation with dimensions indicating length and height of wall.
    c. Drawings shall show all wall openings. Indicate opening size and location with dimensions.
    d. Locations of contraction (control) joints.
    e. Plan details of columns and pilasters and coursing.
    f. Drawings shall indicate the location of all conduit, plumbing and other items embedded in the masonry walls.
    g. Drawings shall be to scale.

21. Structural Repairs: See Section 03 3000.
22. Hazardous Materials Notification: See Section 03 3000.
23. [LEED Submittals:]

B. Submittal Process: See Section 03 3000 or 05 1200

C. SER Submittal Review: See Section 03 3000 or 05 1200

D. Substitution Request: See Section 03 3000 or 05 1200

E. Request for Information (RFI): See Section 03 3000 or 05 1200

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions and Division 1.

B. Delivery:

1. At the time of delivery to the project site, concrete masonry units shall meet the linear shrinkage requirements and physical requirements of ASTM C90. Reject and remove from site all non-conforming materials.

C. Storage:

1. Store units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproofing sheeting, securely tied. If units become wet, do not install until they are dry.
2. Store cementitious materials on elevated platforms, under cover and in a dry location. Use of cementitious materials that have become caked or hardened from moisture absorption will not be permitted.
3. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
4. Deliver pre-blended, dry mortar mix in moisture-resistant containers. Store pre-blended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

5. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

D. Handling:

1. Handle fine and coarse aggregates as separate ingredients.

1.8 PRE-INSTALLATION CONFERENCE

A. At least 30 working days prior to the start of concrete masonry unit construction, the Contractor shall hold a meeting to review the approved mortar and grout mix designs and to determine the procedures for producing proper concrete masonry unit construction. The Contractor shall notify the Design Professionals of the meeting and require responsible representatives of every party who is concerned with the concrete masonry unit Work to attend the conference, including but not limited to the following:

1. Contractor.
2. Testing Agency representative.
3. Admixture manufacturer(s).

B. Minutes of the meeting shall be recorded and distributed by the Contractor to all parties concerned within five working days of the meeting. One copy of the minutes shall also be furnished to the following:

1. Design Professionals.
2. Owner's Representative.

C. The minutes shall include a statement by the masonry contractor and admixture manufacturer(s) indicating that the proposed mix design can produce the concrete masonry unit properties and quality required by these Specifications.

1.9 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. See Section 01 4500.

1.10 QUALITY CONTROL BY CONTRACTOR

A. See Section 01 4500 and 03 3000.

1.11 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. Observations: See Section 03 3000 or 05 1200.

B. Corrections by Design Professionals: See Part 3 - CORRECTIVE MEASURES section of this specification.

1.12 PERMITS AND WARRANTY

A. Permits: See Section 03 3000 or 05 1200.

B. Warranty: See Section 03 3000 or 05 1200. Failures include but are not limited to the following:

1. Oily, waxy or loose residue which may interfere with the bonding or discoloration of various applied Architectural finish materials.
2. Discoloration of concrete masonry unit surfaces scheduled to remain exposed as a finish.
3. Areas which show surface failure or defects.
4. Areas which are not properly prepared to receive Architectural finish materials. If necessary, the Contractor, at his own expense, shall have the Testing Agency perform appropriate tests for bond and discoloration.

PART 2 - PRODUCTS

2.1 GENERAL

A. Concrete masonry shall have the minimum compressive strength f'm as indicated in the Structural Drawings.

B. Provide units and materials from a single source and of the same brand throughout the project.

2.2 CONCRETE MASONRY UNITS

A. ASTM C90

1. Net area compressive strength of concrete masonry units shall be as indicated on Structural Drawings.
2. Density classification shall be as indicated on Structural Drawings.
3. Units shall be 8" (203.2 mm) nominal in height and 16" (406.4 mm) nominal in length. Nominal unit thicknesses shall be as indicated on Structural Drawings. Actual dimensions shall be manufactured to 3/8" (9.5 mm) less than nominal dimensions.

B. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bond beams and other special conditions.

C. At exposed faces, provide color and texture matching the range represented by Architect's sample.

2.3 MORTAR AND GROUT

A. General:

1. Site mixing of mortar or grout shall not be permitted without review and acceptance of Contractor's procedure by the Testing Agency.
2. Measure all materials accurately. Shovel measurements will not be permitted.
3. Mortar and grout shall be mixed by mechanical means. Mixing by hand is not permitted.
4. Completely empty drum before charging succeeding batch of materials.
5. Admixtures:
   a. Do not use admixtures, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, pigments or other admixtures unless otherwise indicated

b. Admixtures (excluding pigment) added to either mortar or grout shall also be added to the other so that both contain the same admixtures.
c. Do not use admixtures that contain chlorides.

B. Mortar:

1. Conform to ASTM C270:
   a. Mortar type shall be as indicated on Structural Drawings
   b. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   c. Do not admixtures that contain chlorides.
   d. Color:
      i. Mineral oxide pigments only.
      ii. Provide mortar that is uniform in color throughout job.

2. Mixing:
   a. Furnish dry mortar ingredients in the form of a pre-blended mix.
   b. Mix cementitious materials and aggregates on site in batch mechanical mixer
      i. Place approximately half of the required water and aggregate into the mixer while turning.
      ii. Add cement and remainder of the aggregate and water into mixer in that order.
      iii. Add lime and continue mixing as long as required to secure a uniform mass.
      iv. Total mixing time may not be less 3 minutes nor more than 5 minutes.
   c. Maintain workability of mortar by remixing or re-tempering
   d. Do not hand mix mortar.
   e. Discard mortar which has begun to stiffen or is not used with 2-1/2 hours after initial mixing.
   f. Limit weight of mineral oxide or carbon black pigments added to project site prepared mortar in accordance with TMS 602.

C. Grout:

1. Conform to ASTM C476:
   a. Compressive strength as indicated on Structural Drawings.
   b. Contractor shall furnish fine grout at no additional cost to the Owner if the clear width of grout space or the clear grout space dimensions for grouting cells of hollow units of the constructed masonry is less than the minimum for course grout per Table 3.2.1 of TMS 402.

2. Mixing:
   a. Mix grout in accordance with ASTM C476.
   b. Furnish dry ingredients in the form of a pre-blended mix.
   c. Mix ingredients in a mechanical batch mixer for a minimum of 5 minutes.
   d. Use sufficient water to make a workable mix that will flow into all joints for the masonry units with typical rates of absorption per ASTM C90.
   e. Slump shall be between 8” (203.2 mm) and 11” (279.4 mm)

D. Self-Consolidating Grout:

1. Conform to ASTM C476.
2. Mixing:
   a. Furnish dry ingredients in the form of a pre-blended mix.
   b. Mix ingredients in a mechanical batch mixer for a minimum of 5 minutes.

c. Add water in accordance with the self-consolidating grout manufacturer's recommendations.
d. Slump shall be between 24" (609.6 mm) and 30" (762 mm)
e. Field addition of admixtures is not permitted.

2.4 ADMIXTURES

A. General:

1. Admixtures specified below can be used only when established in the mix design with Design Professionals' prior written approval.
2. Each admixture approved by Design Professionals shall be used in strict compliance with manufacturer's published instructions.
3. Mortar and grout suppliers shall certify all admixtures to be compatible with each other. (See Submittals Section in Part 1)

B. Air Entraining Admixture:

1. Not permitted in mortar or grout mixes.

C. Retarding Admixture:

1. ASTM C 494, Type B
2. Acceptable Product: Fritz Pak "Mortar Set Retarder"
3. Acceptable Product: Grace Construction & Packaging "Mortard-E"
4. Acceptable Product: Euclid Chemical Company "Eucon Retarder 100m"

D. Non Corrosive Accelerating Admixture:

1. ASTM C 494, Type C
2. Acceptable Product: Fritz Pak "Mortar Set Accelerator"
3. Acceptable Product: Euclid Chemical Company "Euco Winter Admixture"
4. Acceptable Product: Grace Construction & Packaging "Morset"

E. Water-Reducing and Accelerating Admixture:

1. ASTM C 494, Type E
2. Acceptable Product: Fritz Pak "Mortar Set Accelerator"
3. Acceptable Product: Euclid Chemical Company "ACCELGUARD 80 Mortar"
4. Acceptable Product: Kaufman Products, Inc. "Excell NC 80"

2.5 REINFORCEMENT AND METAL ACCESSORIES

A. Reinforcement Bars

1. Horizontal and vertical reinforcement bars shall comply with requirements of Section 03 2000

B. Joint Reinforcement

1. ASTM A951

2. Carbon Steel
3. Ladder Type Reinforcement:
    a. Longitudinal rod size shall be as indicated on Structural Drawings
    b. Joint reinforcement width to match thickness of units.
    c. Spacing of cross ties and of points of connection of cross ties to longitudinal rods to be 16" (406.4 mm) on-center maximum.
    d. Provide in lengths of not less than 10'-0" (3.05 m).
    e. Provide prefabricated corner and Tee Units.

C. Anchors, Ties and Accessories:

1. Wire Mesh Ties: ASTM A185
2. Wire Ties and Anchors: ASTM A82
3. Headed Anchor Rods: ASTM 307

D. Coatings for Corrosion Protection: Unless otherwise noted, protect carbon steel joint reinforcement, ties and anchors from corrosion by galvanizing in conformance with the following minimums:

1. Hot-Dip Galvanized Coatings per ASTM A153
2. Mill Galvanized Coatings per ASTM A641

2.6 MISCELLANEOUS cmu and cmu related PRODUCTS

A. Reinforcement Bar Positioners:

1. Provide positioners with two eyes or four eyes for CMU walls with one or two layers of vertical reinforcement respectively.
2. Provide positioner size for each thickness of CMU walls indicated on drawings.
3. Vertical spacing shall not exceed 16" (406.4 mm) on-center.
4. Hot dip galvanized per ASTM A153.
5. Acceptable Products:
    a. Heckmann Building Products: "#376 Rebar Positioner".
    b. Hohmann & Barnard: "RB Rebar Positioners" or "BR-Twin Rebar Positioners".

B. Contraction (Control) Joint Material:

1. Shall comply with ASTM D200, M2AA-805 with rubber shear keys with a minimum durometer hardness of 80.

C. Top of Wall Anchors:

1. All anchor components, inserts, dovetail slots and post installed anchors to be hot-dipped galvanized or stainless steel
2. Acceptable Products:
    a. For interior, non-load bearing partitions in Seismic Design Categories A and B only:
        i. PTA Series by Blok-Lok
        ii. PTA Series by Hohmann and Barnard
        iii. At Post-Tensioned Slabs provide dovetail slots or 3/4" (19.1 mm) maximum depth post-installed anchors

b. For interior, non-load bearing partitions or exterior back-up walls in Seismic Design Categories A and B only:
   i. LSA Series by Blok-Lok
   ii. At Post-Tensioned Slabs provide dovetail slots or 3/4” (19.1 mm) maximum depth post-installed anchors

D. Post-installed Anchors:

1. See Structural General Notes and Specification 03 2000.

E. Embedded Conduits, Pipes and Sleeves

1. Materials shall be compatible with masonry.
2. Aluminum materials are not permitted.

PART 3 - EXECUTION

3.1 CONTRACTOR INSPECTION

A. Prior to start of masonry construction, the Contractor shall verify:

1. The foundation is constructed within a level alignment tolerance of +/- 1/2" (12.7 mm) per Figure SC-8 of TMS 602.
2. Reinforcement dowels are positioned in accordance with the Contract Drawings and are free from loose scale, dirt, concrete or other bond inhibiting substances.
3. Edge is true to permit projection of masonry to less than 1/4" (6.4 mm).

B. Contractor shall immediately notify the Design Professionals stated conditions are not met. Construction of masonry shall not begin until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Cleaning:

1. Clean concrete surfaces to receive masonry. Remove Laitance, loose aggregate and anything else that would prevent mortar from bonding to supporting concrete.
2. Clean reinforcement and shanks of anchor rods by removing mud, oil or other materials that will adversely affect or reduce bond at the time mortar or grout is placed.
3. Reinforcement with rust, mill scale or both are acceptable without cleaning or brushing provided that the dimensions and weights, including heights of deformations, of a cleaned sample are not less than required by ASTM A615.

B. Wetting:

1. Unless otherwise required, do not wet concrete masonry. Wet cutting is permitted.

C. Debris:

1. Construct grout spaces free of mortar dropping, debris, loose aggregates, and any material deleterious to masonry grout.
2. Remove any insulating material from cells that are to receive grout, including polystyrene insulating inserts, prior to grouting.

D. Reinforcement:

1. Place reinforcement and ties in grout spaces prior to grouting.

E. Cleanouts:

1. For grout pours that exceed 5'-4" (1.63 m) in height, provide cleanout openings in the bottom course of masonry for each grout pour.
   a. Construct cleanouts so that the space to be grouted can be cleaned and inspected. In solid grouted masonry, space cleanouts horizontally at a maximum of 32" (813 mm) on center.
   b. Construct cleanouts with an opening of sufficient size to permit removal of debris. The minimum opening dimension shall be 3" (76.2 mm).
   c. After cleaning, close cleanouts with closures braced to resist grout pressure.

A. Ensure CMU are clean and free from dust, dirt or other foreign materials.

B. Approved mix designs must be maintained on file in Contractor's Field Office.

C. Do not place grout having a slump outside of allowable slump range.

D. Unless adequate protection is provided, CMU shall not be placed during rain.

E. Rain water shall not be allowed to increase mixing water.

F. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint thickness and to accurately locate wall openings, movement joints, returns and offsets.

3.3 MASONRY ERECTION

A. Bond Pattern:

1. Unless otherwise indicated in the drawings, lay masonry in running bond.

B. Placing Mortar and CMU

1. General
   a. Place clean CMU and adjust to final position while mortar is soft and plastic. Remove and re-lay in fresh mortar any unit disturbed to the extent that bond is broken after initial positioning.
   b. Cut exposed edges or faces of CMU smooth, or position so that exposed faces or edges are unaltered manufactured surfaces.
   c. When the bearing of a masonry wythe on its support is less than 2/3 of the wythe thickness, notify the Design Professional in writing.
   d. Use full size units if possible. Avoid using less than one half size units at jambs, lintels, sills and corners.

e. Cutting of units shall be performed with motor-driven saws to produce clean, unchipped edges. If wet cutting is used, allow units to dry before laying unless otherwise specified. Install cut units so that cut edges and surfaces are concealed.
f. Ensure random color variations of CMU by selecting CMU to be laid from three delivered pallets. Alternate pallets as work progresses.
g. Install anchors and other embedded items accurately as work progresses and prior to grouting.
h. Align cells of units vertically.
i. Where longitudinal run is to be stopped, rack back one half block length in each course. Toothing of units is not permitted.
j. Temporary Formwork and Shoring:
   i. Construct formwork and shores as required to support masonry unit during construction
   ii. Construct formwork to provide shape, line and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar or grout. Brace forms to maintain position and shape during construction and curing of masonry.
   iii. Do not remove forms or shores until masonry has sufficiently cured to carry its self-weight and other construction loads.

2. Bed Joints at Base of Masonry unit:
   a. In the starting course on foundations and other supporting members, construct bed joints so that the bed joint thickness is at least 1/4" (6.4 mm) and not more than:
      i. 3/4" (19.1 mm) when the masonry unit is not grouted or partially grouted.
      ii. 1-1/4" (31.8 mm) when the first course of the masonry unit is grouted solid and supported by a concrete foundation.

3. Bed and Head Joints:
   a. Construct 3/8" (9.5 mm) thick bed and head joints except as indicated for bed joints at base of masonry unit.
   b. Fill holes not specified in exposed and below grade masonry with mortar.
   c. Tool joints slightly concave using a jointer larger than joint thickness to achieve solid, smooth, watertight joints when the mortar is thumbprint hard.
   d. Remove masonry protrusions extending 1/2" (12.7 mm) or more into cells or cavities to be grouted.
   e. Butter ends with sufficient mortar to fill head joints and shove in place. Do not slush head joints.
   f. Where concealed, cut off mortar flush with face of wall using trowel.

4. Collar Joints:
   a. Solidly fill collar joints less than 3/4" (19.1 mm) wide with mortar as the work progresses.

5. Hollow CMU: Place hollow units so:
   a. Face shells of bed joints are fully mortared.
   b. Webs are fully mortared in:
      i. All courses of piers, columns and pilasters.
      ii. When necessary to confine grout our insulation.
   c. Head joints are mortared, a minimum distance from each face equal to the face shell thickness of the CMU.
   d. Vertical cells to be grouted are aligned and unobstructed openings for grout are provided in accordance with the drawings.

C. Embedded Items and Accessories:

1. Construct chases as masonry units are laid.
2. Install pipes and conduits passing horizontally through masonry partitions.
3. Place pipes and conduits passing horizontally through piers, pilasters, or columns.
4. Place horizontal pipes and conduits in and parallel to plane of walls.
5. Install and secure connectors, flashing, weep holes, weep vents, nailing blocks, and other accessories.
6. Install movement joints.
7. Do not embed aluminum conduits, pipes, and accessories.
8. Conduits and pipes shall not be embedded in grouted cells with vertical or horizontal reinforcement without prior written approval of Design Professional.
9. Do not cut, bend or displace the reinforcement to facilitate placement of embedded items.
10. Maintain minimum clear cover between embedded items and reinforcement.

D. Bracing of CMU:

1. Bracing and shoring to be designed by the Contractor's engineer. The need for bracing and shoring is to be determined by the Contractor's engineer.
2. Design, provide, and install bracing that will assure stability of CMU during construction.
3. Construction equipment shall not be laterally braced to masonry unit walls without prior written approval from the Design Professional.

E. Site Tolerances:

1. Erect CMU within the following tolerances from the specified dimensions. If specified tolerances cannot be met due to previous construction, notify the Design Professional in writing.
2. Dimension of elements:
    a. In cross-section or elevation: -1/4" (6.4 mm), + 1/2" (12.7 mm)
    b. Mortar joint thickness: +/- 1/8" (3.2 mm).
    c. Grout space or cavity width: -1/4" (6.4 mm), + 3/8" (9.5 mm).
3. Elements:
    a. Variation from level:
        i. Bed joints and top surface of load bearing walls: +/- 1/4" (6.4 mm) in 10'-0" (3.05 m), +/- 1/2" (12.7 mm) maximum.
    b. Variation from plumb and true to a line: +/- 1/4" (6.4 mm) in 10'-0" (3.05 m), +/- 3/8" (9.5 mm) in 20'-0" (6.1 m), +/- 1/2" (12.7 mm) maximum.
    c. Alignment of columns and walls (bottom versus top):
        i. Load bearing walls and columns: +/- 1/2" (12.7 mm).
        ii. Non-bearing walls: +/- 3/4" (19.1 mm).
4. Location of elements:
    a. Indicated in plan: +/- 1/2" (12.7 mm) in 20'-0" (6.1 m), +/- 3/4" (19.1 mm) maximum.
    b. Indicated in elevation: +/- 1/4" (6.4 mm) in story height, +/- 3/4" (19.1 mm) maximum.

3.4 CONTRACTION (CONTROL) JOINTS:

A. Install contraction (control) joints at locations indicated on the drawings in all masonry walls. Nonstructural reinforcement, such as horizontal joint reinforcement, shall not be continuous through contraction (control) joints. Structural reinforcement, such as bond beam reinforcement, shall be continuous through contraction (control) joints.

3.5 REINFORCEMENT, TIES, AND ANCHOR INSTALLATION:

A. General:

1. Place reinforcement and anchors in accordance with sizes, types and locations indicated in the drawings.
2. Do not place dissimilar metals in contact with each other.
3. Place all reinforcement and embedded items prior to grouting.

B. Reinforcement Bars:

1. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar beyond allowable tolerances.
2. Completely embed all reinforcement bars and dowels in grout.
3. Clear distance between reinforcement and concrete masonry unit or mortar protrusion into cell shall be 1/2" (12.7 mm) minimum for course grout and 1/4" (6.4 mm) minimum for fine grout.
4. Clear cover of reinforcement shall be in accordance with Structural Drawings with the following minimums:
    a. Masonry face exposed to earth or weather:
        i. Bars #5 and smaller: 1-1/2" (38.1 mm)
        ii. Bars larger than #5: 2" (50.8 mm)
    b. Masonry not exposed to earth or weather:
        i. All bar sizes: 1-1/2" (38.1 mm)
5. Maintain a minimum clear distance between parallel bars of (1) bar diameter or 1" (25.4 mm) whichever is greater. Where size of parallel bars varies, bar diameter used to determine minimum clear spacing shall be that of the larger bar.
6. In columns and pilasters, maintain minimum clear distance between vertical bars of one and one-half times the nominal bar size or 1-1/2" (38.1 mm), whichever is greater.
7. Splice bars as indicated in the drawings.
8. Do not bend reinforcement after it is embedded in grout.
9. Position bars spliced by noncontact lap splice no farther apart transversely than one-fifth the required lap length nor more than 8" (203.2 mm).
10. Horizontal bars that are lap spliced may be stacked vertically to ease grout placement.
11. Splices shall not cross cold joints in grout.

C. Joint Reinforcement:

1. Place joint reinforcement so that longitudinal wires are embedded in mortar with a minimum cover of 5/8" (15.9 mm) when exposed to weather or earth. Provide 1/2" (12.7 mm) clear cover elsewhere.
2. Provide minimum 6" (152.4 mm) lap splices.

3. Ensure that all ends of longitudinal wires of joint reinforcement at laps are embedded in mortar or grout.
4. Space joint reinforcement not more than 16" (406.4 mm) on-center.

D. Reinforcement Placement Tolerances:

1. Place reinforcement bars in walls and flexural elements masonry unit within the following tolerances when the distance from the centerline of bars to the opposite face of masonry is as follows:
   a. Equal to 8" (203 mm) or less: +/- 1/2" (12.7 mm).
   b. Less than 24" (610 mm) and greater than 8" (203 mm): +/- 1" (25.4 mm).
   c. Greater than 24" (610 mm): +/- 1-1/4" (31.8 mm).

2. Place vertical bars within the following tolerances along the length of the wall when the wall segment length is as follows:
   a. Equal to 24" (610 mm) or less: +/- 1" (25.4 mm) of required location.
   b. Greater than 24" (610 mm): +/- 2" (50.8 mm).

3. If it is necessary to move bars more than one bar diameter or a distance exceeding the tolerance stated above to avoid interference with other reinforcement, conduits, or other embedded items, notify the Design Professional in writing.
4. Foundation dowels that interfere with webs of CMU may be bent to a maximum of 1" (25.4 mm) horizontally for every 6" (152.4 mm) of vertical height.
   a. It is acceptable to remove a portion of the web to accommodate a bent dowel as long as the dowel is fully encapsulated in grout and masonry cover is maintained.

E. Anchor Rods:

1. Anchor rods shall be embedded in grout.
2. Place anchor rods prior to grouting. Anchor rods shall not be forced into previously poured grout.
3. Maintain minimum masonry cover between anchor rods and masonry inside cells of CMU.
4. For anchor rods placed through a face shell:
   a. The rods may fit tight to the hole drilled through the face shell.
   b. If the hole drilled through the face shell is of a larger diameter than the rod, minimum masonry cover must be provided between the rod and the edge of the hole.

3.6 GROUT PLACEMENT:

A. General:

1. Place grout within 1-1/2 hours from introducing water in the mixture and prior to initial set.
   a. Discard site-mixed grout that does not meet the specified slump without adding water after initial mixing.

2. For ready-mixed grout:
   a. Addition of water is permitted at the time of discharge to adjust slump.
   b. Discard ready-mixed grout that does not meet the specified slump without adding water, other than the water that was added at the time of discharge.
   c. The time limitation is waived as long as the ready-mixed grout meets the specified slump.

3. Confinement: Confine grout to the areas indicated on the drawings. Use material to confine grout that permits bond between masonry units and mortar.
4. Ensure grout flows into voids and completely surrounds reinforcement steel, anchor rods, and embedded items.
5. Grout from inside face of masonry where possible.
6. Do not wet grout spaces prior to grouting.
7. The contractor shall ensure that the masonry has sufficiently cured so that grouting operations will not displace units.
    a. Reinforcement steel shall be in place prior to grouting. Reinforcement shall not be forced into previously poured grout.

B. Grout Pour Height:

1. For conventional and self-consolidating grout, do not exceed the maximum grout pour height given in Table 7 of the TMS 602.

C. Grout Lift Height:

1. Conventional Grout Lift Height:
    a. Where the following conditions are met, place grout in lifts not exceeding 12'-8" (3.86 m):
        i. The masonry has cured for at least 4 hours.
        ii. The grout slump is maintained between 10" (254 mm) to 11" (279.4 mm)
        iii. No bond beams are placed between the top and the bottom of the pour height.
        iv. No intermediate reinforced bond beams are placed between the top and bottom of the pour height.
        v. Cleanouts are provided in the bottom course of the masonry.
    b. When the above conditions are not met, place grout in lifts not exceeding 5'-4" (1.63 m).

2. Self-Consolidating Grout Lift Height:
    a. When placed in masonry that has cured for at least 4 hours, place in lifts not exceeding the grout pour height.
    b. When placed in masonry that has not cured for at least 4 hours, place in lifts not exceeding 5'-4" (1.63 m) or the grout pour height, whichever is less.

3. Consolidation:
    a. Consolidate grout at the time of placement.
    b. For conventional grout pours of 12" (304.8 mm) or less in height:
        i. Consolidate grout at time of placement by mechanical vibration or by puddling.
    c. For conventional grout pours exceeding 12" (304.8 mm) in height:
        i. Consolidate each lift of grout at time of placement by mechanical vibration.
        ii. Reconsolidate by mechanical vibration after initial water loss and settlement has occurred but not more than 30 minutes after initial consolidation.
    d. Mechanical vibration shall be performed with a low velocity vibrator with 3/4" (19.1 mm) diameter head.
        i. Vibrate each grouted cell for partially grouted walls or alternate cells for fully grouted walls.
        ii. Vibrate at intervals of 16" (406.4 mm) when grouting between wythes.
        iii. Extend vibrator into lift the lesser of 8'-0" (2.4 m) or full depth of lift.
    e. Consolidation and reconsolidation is not required for self-consolidating grout.

4. Grout Keys:
    a. When grouting, form grout keys between grout pours. Form grout keys between grout lifts when the first lift is permitted to set prior to placement of the subsequent lift.
        i. Form a grout key by terminating the grout a minimum of 1-1/2" (38.1 mm) below a mortar joint.
        ii. Do not form keys within beams.
        iii. At beams or lintels laid with closed bottom units, terminate the grout pour at the bottom of the beam or lintel without forming a grout key.

D. Post Installed Anchors:

1. Conform to all manufacturer requirements for preparation and installation.

E. Cold-Weather Placement:

1. When ambient air temperature is below 40°F, implement approved cold- weather procedures and comply with the following provisions:
    a. Do not lay masonry units having either a temperature below 20°F or containing frozen moisture, visible ice or snow on the surface.
    b. Do not build on frozen substrates. Remove visible ice and snow form the top surface of existing foundations and masonry to receive new construction. Heat these surfaces above freezing using methods that do not result in damage.
    c. Do not heat water or aggregates use in mortar or grout above 140°F.
    d. Comply with additional cold-weather requirements contained in TMS 602.
    e. Remove and replace CMU that are damaged by frost or freezing conditions.

F. Hot-Weather Placement:

1. When ambient air temperature exceeds 100°F or 90°F with a wind velocity greater than 8 mph, or when hot weather conditions exist that would impair quality and strength of concrete masonry unit, comply with the following provisions:
    a. Mixing water may be chilled, or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
    b. Comply with additional hot-weather requirements contained in TMS 602.

3.7 PROTECTION

A. Normal Conditions:

1. Protection of Masonry:
    a. During construction, cover top of walls, projections, and sills with waterproof sheeting at end of each day's work.
    b. Cover partially completed masonry when construction is not in progress.
    c. Waterproof sheeting shall extend 24" (610 mm) minimum down each side of wall and be held securely in place.

2. Stain Prevention:
    a. Prevent grout and mortar and soil from staining the face of CMU to be left exposed or painted.
    b. Remove grout, mortar and soil that come in contact with such masonry.

3. Do not apply uniform or concentrated loads to CMU walls, pilasters or columns for at least three days after completion.
4. Remove misplaced grout or mortar immediately.
5. Protect sills, ledges, offsets and similar items from mortar drippings or other damage during construction.
6. Protect surrounding work as required against damage from masonry work.

B. Cold-Weather Protection:

1. When concrete masonry unit is placed under conditions of cold weather placement, take additional precautions as specified in TMS 602 when curing, monitoring and protecting the masonry.

C. Hot-Weather Protection:

1. When concrete masonry unit is placed under conditions of hot weather placement, take additional precautions as specified in in TMS 602 and as specified when curing, monitoring and protecting the masonry.
   a. Hot weather protection is required if hot weather conditions occur within a 24-hour period after completion of concrete masonry unit placement.

3.8 POINTING AND CLEANING

A. Point holes or defective mortar joints upon completion of work. Where necessary, cut out and re-point defective joints.

B. In-Progress Cleaning:

1. Hand clean masonry unit by brushing to remove mortar splotches from walls after initial set. Do not use steel wire brushes.
2. Excess mortar should be periodically removed from scaffolding.
3. Grout spills should be removed immediately by washing and brushing.
4. The base of wall should be protected from splashing mud and mortar and grout droppings by spreading plastic sheets 3’-0” (0.91 m) to 4’-0” (1.22 m)on the ground adjacent to the wall and 2’-0” (0.61 m) to 3’-0” (0.91 m) up the face of the wall.

C. Final Cleaning:

1. Ensure mortar joints have cured prior to beginning cleaning.
2. Adjacent work or landscaping should be adequately protected so as to not be damaged by cleaning methods.
3. Test cleaning methods on an inconspicuous sample wall panel. Leave one-half of panel uncleaned for comparison purposes. Observe panel from a distance of 20’-0” (6.1 m) under diffused lighting to evaluate the results.
4. All masonry surfaces shall be cleaned by the same methods to produce a uniform appearance. Avoid overlap of areas being cleaned.
5. Brushing should be done with a dry, stiff-bristled brush. Do not use steel wire brushes.
6. Approved cleaning methods:
   a. Hand cleaning by brushing
   b. Water cleaning

i. Remove mortar, grout and dirt by brushing.
ii. Soak wall with water and scrub with a mild detergent that will not alter the appearance of the masonry units.
iii. Rinse wall with water.
iv. Do not use more water than required.

D. Waste Disposal:

1. Upon completion of work, remove from site surplus materials, rubbish and debris resulting from concrete masonry unit work.

3.9 EVALUATION AND ACCEPTANCE OF CMU

A. If, at any time during construction, the mortar or grout resulting from the approved mix design deviates from Specification requirements for any reason, such as lack of workability, or insufficient strength, the Contractor shall have his laboratory verify the deficiency and modify the mix design, until the specified mortar or grout is obtained. Modified mix to be submitted for approval per Part 1 - SUBMITTALS.

3.10 CORRECTIVE MEASURES

A. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in Part 3 – CORRECTIVE MEASURES section of Specification 03 3000.

END OF SECTION

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SECTION 04 7200 - CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-stone trim.

B. Related Sections:

1. Section 04 2000 "Unit Masonry" for installing cast-stone units in unit masonry.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For cast-stone units, include dimensions and finishes.

B. Shop Drawings: Show fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

C. Samples for Verification:

1. For each color and texture of cast stone required, 10 inches square in size.
2. For each trim shape required, 10 inches in length.
3. For colored mortar.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast-stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Cast Stone: Obtain cast-stone units from single source from single manufacturer.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

2.2 CAST-STONE UNITS

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

1. Continental Cast Stone Manufacturing, Inc.
2. Edwards Precast Concrete Co.
3. Pineapple Grove Designs.
4. RockCast, Division of Reading Rock, Inc.
5. Stonco.
6. Sun Precast Co., Inc.
7. Superior Precast Products

B. Cast-Stone Units: Comply with ASTM C 1364.

1. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

D. Cure Units as Follows:

1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:
   a. No fewer than five days at mean daily temperature of 70 deg F or above.
   b. No fewer than six days at mean daily temperature of 60 deg F or above.
   c. No fewer than seven days at mean daily temperature of 50 deg F or above.
   d. No fewer than eight days at mean daily temperature of 45 deg F or above.

E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

F. Colors and Textures: As selected by Architect from manufacturer's full range.

2.3 MORTAR MATERIALS

A. Provide mortar materials that comply with Section 04 2000 "Unit Masonry."

2.4 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from steel complying with ASTM A 36/A 36M and hot-dip galvanized to comply with ASTM A 123/A 123M.

B. Dowels: 1/2-inch- diameter round bars, fabricated from steel complying with ASTM A 36/A 36M and hot-dip galvanized to comply with ASTM A 123/A 123M.

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast-stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
   b. EaCo Chem, Inc.
   c. PROSOCO, Inc.

2.5 MORTAR MIXES

A. Comply with requirements in Section 04 2000 "Unit Masonry" for mortar mixes.

B. Comply with ASTM C 270, Proportion Specification.

1. For setting mortar, use Type N.
2. For pointing mortar, use Type N.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

A. Install cast-stone units to comply with requirements in Section 04 2000 "Unit Masonry."

B. Rake out joints for pointing with sealant to depths of not less than 3/4 inch. Scrub faces of units to remove excess mortar as joints are raked.

C. Point joints with sealant to comply with applicable requirements in Section 07 9200 "Joint Sealants."

1. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

D. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Build in compressible foam-plastic joint fillers where indicated.
3. Form joint of width indicated, but not less than 3/8 inch.
4. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 9200 "Joint Sealants."

3.3 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04 7200

SECTION 05 1200
STRUCTURAL STEEL

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to requirements of Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections.

1.2 SCOPE

The work covered by this Section shall include all labor, material, equipment, permits, engineering and other services necessary for the fabrication and installation of structural steel and related work, complete, in accordance with the Drawings and as specified herein.

RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 4500
Concrete Reinforcement and Embedded Assemblies	Section 03 2000
Cast-In-Place Concrete	Section 03 3000
Steel Joists	Section 05 2000
Steel Deck	Section 05 3000
Miscellaneous Metals	Division 5
Fireproofing	Division 7
Painting	Division 9
Elevators	Division 14

1.3 CODES AND STANDARDS

A. Building Code: Structural steel work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. American Institute of Steel Construction (ANSI/AISC 360) "Specification for Structural Steel Buildings" per Structural General Notes.
2.
3. American Institute of Steel Construction (AISC 303), "Code of Standard Practice" (COSP). Due to potential conflicts between the governing contracts and parts of Section 1 through 5 of the COSP, Sections 1 through 5 are excluded from these Contract Documents. Prior to bid, the Owner and

Contractor, in consultation with the Design Professionals, can discuss and determine if any excluded provisions are appropriate to include in the Contract Documents.

4. American Welding Society, AWS D1.1, "Structural Welding Code".
5. Research Council on Structural Connections (RCSC) - "Specification for Structural Joints Using High Strength Bolts".
6. American Society for Testing and Materials "ASTM Standards in Building Codes", various standards as referenced herein.
7. The Society for Protective Coatings (formerly Steel Structures Painting Council, “SSPC”) "Steel Structures Painting Manual".

C. Definitions:

1. The term “Contract Documents” in this Specification is defined as the design Drawings and the Specifications.
2. The term “SER” in this Specification is defined as the Structural Engineer of Record for the structure in its final condition.
3. The term “Design Professionals” in this Specification is defined as the Owner’s Architect and SER.
4. The term “Contractor” in this Specification is defined to include any of the following: General Contractor and their sub-contractors, Construction Manager, Structural Steel Fabricator or Structural Steel Erector.
5. The term “Heavy Sections” in this Specification is defined to include hot rolled steel shapes with flanges exceeding 1 1/2 inches (38mm) in thickness and built up cross sections with plates exceeding 2 inches (50mm) in total thickness.
6. The term “High Restraint Weld” describes welds in which there is almost no freedom of movement for members joined due to geometry or material thickness.
7. The term “Testing Agency” in this Specification is defined as an independent testing and inspection service engaged by the Owner for quality assurance testing and inspection of structural construction in accordance with applicable building code provisions and any additional activities listed in the Contract Documents.
8. The terms “for record” and “submit for record” in this Specification are defined as Contractor submittals that do not require a response from the Design Professionals.
9. The term “Working Days” in this Specification is defined as Monday through Friday, except for federal or state holidays.
10. The term “Delegated Design” in this Specification is defined as a scope of work that meets performance and design criteria established in the Contract Documents and is to be completed by the Contractor’s licensed engineer.

1.4 CONTRACTOR QUALIFICATIONS

A. Qualification Data: Submit for record qualification data (personnel and firm resumes, and project lists with references) for the Structural Steel Fabricator (“Fabricator”), Structural Steel Detailer (“Detailer”), Contractor’s Engineer(s) and Structural Steel Erector (“Erector”).

B. The Fabricator shall have 10 years of comparable experience in installations of this type and shall employ labor and supervisory personnel familiar with the type of installation, experienced in fabrication and erection of structural steel for projects of similar size and complexity. At the time of bid the Fabricator shall be AISC certified to the Standard for Steel Building Structures (BU) and must submit proof of these qualifications. The Fabricator’s qualifications shall be subject to review by the Design Professionals and Owner.

C. The Detailer shall have 10 years experience preparing detailed steel shop drawings and CNC downloads for structures of this type and complexity. The detailer's qualifications shall be subject to review by the Design Professionals and Owner.

D. The Contractor's Engineer(s) shall be qualified to perform the type of work required by the project. The Engineer shall be a Professional Engineer licensed in the state where the project is located. The Contractor's Engineer(s) shall have 10 years of experience being in responsible charge of work of this nature. The proposed Engineer(s) shall be subject to approval of Design Professionals and Owner.

E. The Erector shall have 10 years of successful experience erecting structural steel for structures of this type and complexity in the region of the project. At the time of bid the Erector shall be an AISC Certified Steel Erector (CSE) and must submit documentation of this qualification

F. Welding: Qualify the welding procedures, shop welders, field welders, welding operators and tackers in accordance with AWS D1.1 and for the following periods of effectiveness of certification:

1. Certification and qualification, including period of effectiveness of welding personnel shall be as specified by AWS D1.1. Certification shall remain in effect for duration of work provided welders are continuously engaged in performing the type of welding for which they are certified, unless welders fail to perform acceptable welding, as determined by the Testing Agency. Certification and re-certification of welding personnel is subject to verification by the Testing Agency. Re-testing for re-certification will be the Contractor's responsibility.

1.5 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested. Reproduction of structural drawings for shop drawings is not permitted.

1. Submittal Schedule
2. Calculations, Shop Drawings and Erection Drawings
3. Submittal Letters
4. Pre-construction Survey
5. Quality Control Program
6. Product Data
7. Samples
8. Welding Procedures Specification (WPS)
9. Welder Certifications
10. Mill Reports
11. As-built surveys

1. **Submittal Schedule**: The contractor shall submit for action a typical connection design calculation and shop drawing submission schedule at least twenty (20) working days prior to commencing submission of connection design calculations and shop drawings.

a) This schedule shall include a list, in order of date to be submitted, of all drawings and other required submittal items scheduled to be submitted. The schedule shall list the proposed submittals for each week, including but not limited to the

number of calculation sheets, erection drawings, and piece drawings, as well as their formats. Once shop drawing submissions have commenced any modification or addition to this schedule must be submitted for action at least twenty (20) working days before the modification or addition is proposed to take place.

a) If at any time the total number of connection design calculations, erection drawings and shop drawings received in any one week period exceeds the amount in the approved schedule by more than 10% for that week, the Design Professionals have the right to add two days to the average turnaround time for each 20% increment in excess of the scheduled quantity for that week's submissions. For example if the weekly total exceeds the schedule by 10% to 20%, two days may be added; if it is exceeded by 21% to 40%, four days may be added. The return dates for subsequent submittals may be extended based on the additional review time stated above.

b) For the purposes of developing a schedule, assume the following review rates:
Calculations – 100 – 8 ½' x 11" sheets per week
Shop drawings – 300 pieces per week

2. **Calculations, Shop Drawings and Erection Drawings** (including Field Work drawings): Submit for action required connection calculations, shop drawings and erection drawings for all structural steel indicated on the Contract Documents.

c) Material shall not be fabricated or delivered before the shop and erection drawings have been approved or approved as noted by the Design Professionals and returned to the Contractor.

d) Connection design calculations: Calculations are required for all details that are not indicated on the Drawings as "Completely Designed." Each calculation package shall be sealed and signed by the Contractor's Engineer.

e) Structural Steel Shop Drawings: Submitted shop drawings shall include layouts and details for each member showing the steel type and grade, size, connections, cuts, copes, holes, bolts, welds, surface treatments (cleaning, shop paint, etc.) and provisions for the connection of other work. Steel type, grade and size for all attached elements shall also be shown.

f) Shop and erection drawings shall contain complete dimensional and geometric information, based on established dimensions shown on Contract Documents, and shall not be scaled from Contract Documents. The shop drawings shall clearly distinguish between shop and field welds and bolts, identify pretensioned high strength bolts and identify surface preparation requirements at slip critical connections.

g) Welds: All welds shall be indicated by standard welding symbols in the "Standard Code for Arc and Gas Welding in Building Construction" or as accepted by the SER. Shop and erection drawings shall show the size, length, and type of each weld, including the electrode type to be used.

h) Bolts: Details for bolt assemblies shall indicate bolt size, length, type and the presence, type and location of washers where required as part of the assembly; distinguish between N and X bolts, distinguish between slip-critical and bearing bolts; specify approved slip critical coatings; and distinguish between shop and field bolts. Also, indicate bolt orientation where required by the Contract Documents.

i) Erection Drawings: The erection drawings shall include plans showing exact locations of base and bearing plates, and/or anchor rods and other embedded items. All field connections not specifically shown on shop drawings shall be shown on erection drawings, including field bolt size, type, number, location and any special installation requirements, and field weld size, type, length and location.

3. Submittal Letters: The Contractor shall submit for record letters from the Contractor's Engineer supervising the preparation of connection designs on shop and erection drawings.

j) A letter shall be submitted along with the first submission of Connection design calculations. It shall be sealed and signed by the Contractor's Engineer, and shall include the following:

"All Connection design calculations for this project have been developed, and all details and connections for this project will be designed, by me, or by qualified personnel under my direct supervision, to resist the loads and reactions indicated on the Contract Documents, except for those connections which are designated as completely designed on the Contract Drawings."

k) A second letter shall be submitted upon the satisfactory submission, review and/or approval of [all] [*each distinct package of*] shop and erection drawings. It shall be sealed and signed by the Contractor's Engineer and include the following:

"All details and connections as shown on the [final] [*listed*] shop and erection drawings for this project have been designed by me, or by qualified personnel under my direct supervision, to resist the loads and reactions indicated on the Contract Documents, except for those connections which are designated as completely designed on the Contract Drawings."

4. **Preconstruction Survey**: Submit for record. Where interface with existing construction occurs, before related shop drawings are prepared survey the existing construction and submit the survey prepared by a professional surveyor employed by the Contractor to the Design Professionals. For all steel construction, before steel erection commences, perform and submit to the Design Professionals a complete survey for position and alignment at all points where construction by other trades will support steel elements, including but not limited to pockets, embedded plates, anchor rods and base plates. Include plan location positions relative to the building gridlines and elevations of bearing surfaces and tops of bolts relative to building Datum elevation. Immediately notify the SER of elements that are not within tolerance.
5. **Quality Control Program**: Submit for record complete details of the Contractor's quality control program including the names of the personnel responsible for this work.
6. **Product Data**: Submit for action manufacturers' specifications, test reports and applicable standards for all products listed under Part 2: Products. Standard literature shall be edited to suit job conditions.
7. **Samples**: Submit for record (2) samples each, (2) of shop painted products and (2) of field touch-up painted products. Samples shall be steel material.
8. **Welding Procedures:** Submit for record all Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR):

l) All Welding Procedures shall be Signed and Sealed by the Contractor's Engineer or Certified Welding Engineer, confirming all essential variables meet design requirements as applicable on the Contract Documents and weld electrode manufacturer's recommendations.

m) The Contractor's Engineer or Certified Welding Engineer shall develop all Special Welding Procedures for Heavy Sections and High Restraint Welds. Special Procedures shall be Signed and Sealed by the Contractor's Engineer or Certified Welding Engineer. Use of AWS D1.1, Annex E forms are recommended for Special Procedure submittals.

9. **Welder Certification**: Submit for record certification that the welders have passed qualification tests using AWS procedures.

n) A certification shall be submitted in standard AWS format.

o) Each certification shall state that the welder has been doing satisfactory welding of the required type within the six-month period prior to the subject work.

For any welder whose period of certification effectiveness has lapsed or whose workmanship is subject to question in the opinion of the Design Professionals or Testing Agency, immediate testing for recertification will be required. Tests, when required, shall be conducted at the sole expense of the Contractor.

10. **Mill Reports**: Submit for record certified copies of all mill reports to the Design Professionals and to the Testing Agency, covering the chemical and physical properties of all structural steel and accessories (as defined in this Specification) for the project.

p) Such certificates shall be obtained from the mills producing the steel and shall certify in a cover letter submitted with the certificates, that the steel meets the minimum requirements as to physical properties, inspection, marking and tests for structural steel as defined by the current edition of the relevant ASTM Standard Specifications. Any steel that does not meet the ASTM requirements must be clearly identified in a cover letter submitted with the certificates.

q) Prior to commencing steel erection, the contractor shall deliver certificates to the Owner in number and form as may be required by the local Building Department or other local and State agencies having jurisdiction.

11. **As-Built Surveys**: Execute and submit for record a comprehensive survey of steel structure at each level adequate to assess if the structure has been built within the tolerances specified in the Contract Documents. Each certified survey, performed by a professional surveyor employed by the Contractor, shall be submitted to the Contractor's Engineer for their approval before proceeding to the next stage of erection. If deviations from the tolerances are discovered, the Contractor shall present corrective measures to the Design Professionals within 48 hours of completion of that stage of erection. Upon completion of steel erection, submit the complete package of steel surveys for record to the Design Professionals and the Owner.

B. Submittal Process

1. Submittal of shop and erection drawings and other submittals by the Contractor shall constitute Contractor's representation that the Contractor has verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with

respect thereto and reviewed or coordinated each drawing with other Drawings and other trades. The Contractor shall place their shop drawing stamp on all submittals confirming the above.

2. Connection design calculations: Calculations are required for all details that are not indicated on the Drawings as "Completely Designed." The Contractor shall submit connection design calculations and receive an action of approval prior to submitting shop drawings related to those calculations. The shop drawings shall incorporate all comments provided on the calculations.
3. Shop and erection drawings: Submit in complete packages so that individual parts and the assembled unit may be reviewed together. This Specification Section and the applicable drawings used in the development of the shop and erection drawings shall be referenced on each shop and erection drawing to facilitate checking. Unless the piece marks are self-indexing, furnish index sheets with the shop drawings, relating piece marks for all beam, girder and column details to the sheet numbers on which they are located.
4. The Contractor shall submit to the Design Professionals one (1) electronic copy for shop drawing review. The naming convention of each drawing must follow the submittal numbering system and include the submittal #, specification #, revision # and drawing # in the prefix of the drawing name.
5. The Contractor shall allow at least **[ten (10)]** working days between receipt and release by the SER for the review of shop and erection drawings and submittals other than connection design calculations. The Contractor shall allow at least **[fifteen (15)]** working days between receipt and release by the SER for the review of connection design calculations.
6. All modifications or revisions to submittals, shop drawings, connection design calculations and erection drawings must be clouded, with an appropriate revision number clearly indicated. The following shall automatically be considered cause for rejection of the modification or revision whether or not the drawing has been approved by the Design Professionals:

    a. Failure to specifically cloud modifications
    b. Failure to submit calculations for the modifications
    c. Unapproved revisions to previous submittals
    d. Unapproved departure from Contract Documents

7. The Contractor shall deliver to the Design Professionals at the completion of the job two (2) electronic versions of the final as-built shop drawings on a CD-ROM or other media acceptable to the Design Professionals.
8. Resubmittals: Completely address previous comments prior to resubmitting a drawing. Resubmit only those drawings that require resubmittal.
9. Resubmittals Compensation: The Contractor shall compensate the Design Professionals for submittals that must be reviewed more than twice due to contractors' errors. The Contractor shall compensate the Design Professionals at the standard billing rates plus out-of-pocket expenses incurred at cost + 10%.

C. SER Submittal Review

1. The review of connection design and the review and approval of shop and erection drawings and other submittals by the Design Professionals shall be for general conformance with the design intent of the work and with the information given in the Contract Documents only and will not in any way relieve the Contractor or the Contractor's Engineer from:

    a. Responsibility for the adequacy of the design of the connections designed by the Contractor's Engineer.
    b. Responsibility for all required detailing.
    c. Responsibility for the proper fitting of construction work in strict conformance with the contract requirements.

d. The necessity of furnishing material and workmanship required by contract Drawings and Specifications which may not be indicated on the shop and erection drawings.
e. Conforming to the Contract Documents.
f. Coordination with other trades.
g. Control or charge of construction means, methods, techniques, sequences or procedures, for safety precautions and programs in connection with the work.

2. TYPE 1 – Structural Submittal Review Stamp: For shop drawings for building elements designed by the SER, the responses on the shop drawing review stamp used by the SER require one of the following actions:

a. APPROVED indicates that the SER has found that the information presented on the shop or erection drawing appears to conform to the requirements of the Contract Documents. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the Contract Documents.
b. APPROVED AS NOTED indicates that the SER requires the shop or erection drawing to be corrected to reflect the notes and comments shown. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the notations shown on the shop drawings and the Contract Documents. Promptly resubmit the corrected shop or erection drawing for record.
c. REVISE and RESUBMIT indicates that the SER requires resubmission of the shop or erection drawing after correction per notes and comments. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed until the Contractor has received a returned shop drawing marked Approved or Approved as Noted.
d. NOT APPROVED indicates that the shop or erection drawing does not conform to the Contract Documents and must be extensively revised before re-submittal. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed until the Contractor has received a returned shop drawing marked Approved or Approved as Noted.

3. TYPE 2 – Delegated Design Review Stamp: For submittals for building elements which are not designed by the SER but are delegated design items, or for items that do not form part of the completed structural system but impose loads on the structure, or for construction items or activities which have an effect on the final structure. The responses on the stamp used by the SER require one of the following actions:

a. NO EXCEPTIONS indicates that the SER has found that the information presented on the submittal appears to conform to the requirements of the Contract Documents. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the Contract Documents.
b. EXCEPTIONS NOTED indicates that the SER requires the submittal be corrected to reflect the notes and comments shown. Fabrication, manufacture or construction of the elements of work shown in the shop drawing may proceed, provided that work is in compliance with the notations shown on the shop drawings and the Contract Documents. Promptly resubmit the corrected document for record.
c. REJECTED indicates that the SER requires resubmission of the submittal after correction per notes and comments. None of the elements of work shown on the shop drawing shall be fabricated, manufactured or constructed. Contractor to revise and resubmit until SER response of No Exceptions or Exceptions Noted is received.

D. Substitution Request

1. Requests for any departure from Contract Documents must be submitted in writing by the Contractor and accepted in writing by the Design Professionals, prior to receipt of submittals.
2. All substitutions must be requested using the structural substitution request form included at the end of this section. Acceptance using the structural substitution request form indicates acceptability of the structural concept only. Contractor must submit shop drawings reflecting accepted substitutions for review in accordance with this Specification. The structural substitution request form, even if accepted, does not constitute a change order.
3. Such substitutions or modifications, if acceptable to the Design Professionals shall be coordinated and incorporated in the work at the sole expense of the Contractor.
4. The acceptance by the Design Professionals of a specific and isolated request by the contractor to deviate from these requirements does not constitute a waiving of that requirement for other elements of, or locations in the project, unless specifically addressed as such and permitted by the Design Professionals in writing.
5. Compensation for Additional Services: Should additional work by Design Professionals such as design, documentation, meetings and/or site visits be required which are necessitated for the review and/or incorporation of the Contractor-requested substitution, including indirect effects on other portions of the work, the Contractor is responsible for paying for additional work performed by the Design Professionals at the standard billing rates plus out-of-pocket expenses incurred at cost + 10%. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.
6. Contractor is responsible for means and methods and any impacts on other portions of the work that may arise from this substitution.

E. Request for Information (RFI)

1. RFI shall originate with the Contractor. RFI submitted by entities other than that Contractor will be returned with no response.
2. Limit RFI to one subject.
3. Submit RFI immediately upon discovery of the need for interpretation or clarification of the Contract Documents. Submit RFI within timeframe so as not to delay the Construction Schedule while allowing the full response time described below.
4. The response time for answering an RFI depends on the category in which it is assigned.
   a. Upon receipt by the SER, each RFI will be assigned to one of the following categories:
      i. No cost clarification
      ii. Shown in Contract Documents
      iii. Change to be issued in future bulletin
      iv. Previously answered
      v. Information needs to be provided by others.
      vi. Request for corrective field work
      vii. Request for substitution
   b. RFIs in the first five categories listed above will be turned around by the SER on average of **[five (5)]** working days.
   c. RFIs in the last two categories listed above will be immediately rejected and must be submitted as submittals or requests for substitution.

1.6 TEMPORARY SUPPORT OF STRUCTURAL STEEL FRAME

The structure as shown on the Contract Documents is designed to withstand the design loads only when all structural elements are installed and fully connected. The contractor shall be responsible for the

analysis of all components and assemblies for stresses and displacements that may be imposed by fabrication, shipping, handling, erection, temporary conditions, construction loads, etc. The analysis of such shall be performed by the Contractor's Engineer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Unload all structural steel promptly upon arrival and store in an area designated and approved by the Owner at the site of the work. The Contractor shall be responsible for any charges from failure to unload material promptly.

B. Storage: Store structural steel to drain properly. Provide weep holes and clean out as required to keep steel free from water. Provide adequate protection and shoring to prevent distortion and other damage. Store structural steel on timber; do not lay on mud, directly on ground or cinders, or otherwise handle in a manner that damages finishes. Stored sections shall be readily accessible for inspection.

C. Store fasteners in a protected place.

D. Welding materials to be in moisture resistant, undamaged package. Maintain packages effectively sealed until electrode is required for use. Storage and handling shall be per AWS D1.1.

1.8 CONNECTION DESIGN AND DETAILING Conference

A. At least 20 working days prior to starting connection design and detailing, the Fabricator shall hold a meeting to verify all connection design assumptions and procedures and shop drawing preparation and submittal procedures.

B. The Contractor shall prepare an agenda and require responsible representatives of every party who is concerned with the connection design and detailing to attend this meeting, including but not limited to:

1. General Contractor
2. Fabricator
3. Detailer
4. Connection Engineer
5. Design Professionals
6. Erector

C. The Fabricator shall prepare an agenda prior to the meeting, and shall distribute meeting minutes to all parties within 5 working days of the meeting.

1.9 DESIGN OF CONNECTIONS

A. The contractor is responsible to design all connections not completely designed on the Contract Documents. A Completely Designed connection is only one that is specifically designated as such by the statement "COMPLETELY DESIGNED" on the Contract Documents. All connections not indicated as "COMPLETELY DESIGNED" shall be designed for the forces and/or connection design criteria called for in the Contract Documents.

B. Connection concepts shown on the Drawings that are not “COMPLETELY DESIGNED” show only the minimum requirements to convey design intent.

C. All connections and details shown on shop and erection drawings shall be prepared under the supervision of the Contractor's Engineer, in accordance with AISC "Load and Resistance Factor Design Specification for Structural Steel Buildings."

D. The contractor shall design and provide any stiffener plates, doubler plates, reinforcing plates, etc. and their connections that may be required to develop and/or transfer the forces and/or connection design criteria called for in the Contract Documents.

E. Design connections to withstand the combined effects of shears, axial forces, moments and torques and as required by applicable code(s) and the Contract Documents.

F. All forces shown on the Drawings are to be assumed reversible unless noted otherwise and must be checked for both directions. If no transfer/pass-through forces are shown on the Contract Documents, the most critical combinations of member forces and directions shall be assumed for the connection design.

G. Use types of shop and field connections shown on Contract Documents or, in absence of such indication, propose appropriate type for Design Professionals review.

H. Welding of High Restraint Welds: Use double bevels in lieu of single bevels where practical. Detail joints to allow for weld shrinkage. In cases of plates in more than one plane, show welding operation sequence on the drawings. In general, start welding at the most restrained part of the weldment and proceed to the least restrained.

I. All welded connection must utilize pre-qualified joints or joints that have been qualified by AWS D1.1: 2015, section 3.

J. Comply with all connection notes on Drawings in conjunction with these Specifications.

K. The connection design calculation submittals shall meet the following criteria:

1. Number each calculation in a logical and orderly system. Once submitted for review, calculations shall not be renumbered. Resubmitted calculations shall be indicated by using the same number with an “R” suffix. All changes must be clouded.
2. Provide sketches for results of each calculation, with all pertinent dimensions relating to the calculations (including pitch, gage, edge distance, unbraced lengths, Whitmore lengths, etc.) clearly shown. Geometry must be shown accurately and to scale. Provide enough sketches to clearly document the full range of geometric conditions applicable to each connection design calculation proposed.
3. For repetitive connections provide a spreadsheet or computer program summary table for each specific location, and a standard calculation which shows how the spreadsheet or program calculation applies.
4. Provide drawings showing the overall locations of the connections that are keyed/referenced to each connection calculation.
5. Calculations shall be typed, or performed by spreadsheet, or by computer program, or by other method approved by the SER. All spreadsheet calculations shall show the input and results for every calculation step and include appropriate text and sketches explaining all calculation assumptions.

6. Provide calculation checks for all forces shown on the Drawings. All AISC code requirements apply. Provide calculations for each check. “OK by inspection” is not permitted.

1.10 STRUCTURAL STEEL PRE-ERECTION CONFERENCE:

A. At least twenty (20) working days prior to the commencing of steel erection the Contractor shall hold a meeting to review the detailed requirements of the steel erection.

B. The Contractor shall prepare an agenda and require responsible representatives of every party who is concerned with the steel erection to attend the conference, including but not limited to the following:

1. General Contractor/Construction Manager
2. Steel Erector / Steel Fabricator
3. Erector’s Surveyor
4. Roof Deck Contractor
5. All Testing and Inspection Agencies
6. Design Professionals
7. Owner
8. Precast or Cladding Contractor as appropriate.

C. Minutes of the meeting shall be recorded, typed and distributed by the Contractor to all parties listed above within 5 working days of the meeting.

D. The minutes shall include a detailed outline of the erection procedure including a schedule of milestone dates for surveys and sign-offs on erection stages which represents an agreement reached by all parties involved. It shall also include the surveying program and submission schedule for approval.

E. Notwithstanding any provision of the Specification, the SER shall not be responsible for and not have charge over any safety programs or precautions at the site of the Project.

1.11 QUALITY ASSURANCE BY OWNER’S TESTING AGENCY

A. See Section 01 4500.

1.12 QUALITY CONTROL BY CONTRACTOR

A. The Contractor shall provide a program of quality control to ensure that the minimum standards specified herein are attained.

B. The Owner's general review during construction and activities of the Testing Agency are undertaken to inform the Owner of performance by the Contractor but shall in no way replace or augment the Contractor's quality control program or relieve the Contractor of total responsibility for quality control.

C. The Contractor shall immediately notify the Design Professionals of any deficiencies in the work which are departures from the Contract Documents which may occur during construction. The Contractor shall propose corrective actions and their recommendations in writing and submit them for review by the Design Professionals. After proposed corrective action is accepted by the Design Professionals and Owner, the

Contractor shall correct the deficiency at no cost to the Owner. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in the OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS section of this Specification.

1.13 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. Observations: The Design Professionals will observe the construction for general compliance with the provisions of the Contract Documents during various phases of construction.

B. Corrections by Design Professionals: See Part 3 - CORRECTIVE MEASURES section of this Specification.

1.14 PERMITS AND WARRANTY

A. Permits: The Contractor shall apply for, procure, renew, maintain, and pay for all permits required by City, State, or other governing authorities, necessary to execute work under this Contract. Contractor shall furnish copies of all permits to the Owner and Design Professionals.

B. Warranty: Comply with General Conditions, agreeing to repair or replace specified materials or work that has failed within the warranty period.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL

A. Structural steel shall conform to the requirements listed on the Structural General Notes.

2.2 SHOP COATINGS

A. Standard Primer: Rust inhibitive, universal phenolic alkyd metal primer 2-4mls. Color to be determined by Architect. Primer shall be compatible with, and from the same manufacturer as, top coats specified in Division 9 specification.

B. Zinc Rich Primer: SSPC-Paint 20, Type I or Type II, Zinc rich primer utilizing either an organic or inorganic binder with a minimum zinc content of 80 percent by weight in the dry film. The primer shall provide a surface meeting AISC Slip Critical Class B (slip coefficient =0.50 min) requirements. Color to be determined by Architect. Primer shall be compatible with, and from the same manufacturer as, top coats specified in Division 9 specification.

C. Hot Dip Galvanizing: ASTM A123, weight of coating shall average not less than **[2.3]** oz per square foot (**[0.70]** kg/ m²), with no individual thickness less than **[2.0]** oz per square foot (**[0.61]** kg/m²).

D. Galvanizing Repair Paint: ZRC Cold Galvanizing Compound, or other coating complying with SSPC-Paint 20.

2.3 ACCESSORIES

A. High Strength Bolts: Conform to the provisions of the Research Council on Structural Connections (RCSC) "Specification for Structural Joints Using High-Strength Bolts" except that nuts shall be ASTM A563 Grades DH or DH3 (hardened) for both A325 and A490 bolts. Twist off type bolts (Tension Control bolts) shall additionally conform to ASTM F1852 or ASTM F2280.

B. All bolts shall be new, and not re-used.

C. Where A325 galvanized bolts nuts and washers are required, they shall be in accordance with ASTM F2329 and ASTM A153, Class C. Where A588 steel is used, bolts, nuts and washers shall be Type 3.

D. Direct Tension Indicators: Meet requirements of ASTM F959.

E. Anchor Rods: Per structural General Notes.

F. Washers:

1. Round washers shall conform to American Standard B 27.2 type b
2. Washers in contact with high-strength bolt heads and nuts shall be hardened in accordance with ASTM Standard F436.
3. Beveled washers shall be square, smooth and sloped so that contact surfaces of the bolt head and nut are parallel.
4. The diameter of the hole of square beveled washers shall be 1/16 inch (1.5mm) greater than the bolt size for bolts smaller than one inch (25mm), and shall be 1/8 inch (3.0mm) greater than the bolt size for bolts larger than one inch (25mm).
5. Comply with requirements of RCSC for all washers including thickness, size and hardness, depending on connection details.

G. Welding Electrodes: Electrodes shall be low hydrogen type and shall have material strength matching characteristics (E70, E80, or E90) as selected from AWS D1.1, Table 3.2.

1. Shielded Metal-Arc Welding (SMAW): Welding electrodes for manual SMAW shall have a maximum H4 series level of diffusible hydrogen and conform to the Specification for Carbon Steel Electrodes; AWS A5.1, or the Specification for Low-Alloy Steel Electrodes; AWS A5.5.
2. Gas Metal-Arc Welding (GMAW): Welding electrodes for semiautomatic GMAW shall have a maximum H4 series level of diffusible hydrogen and conform to the Specification for Carbon Steel Electrodes and Rods; AWS A5.18, or the Specification for Low-Alloy Steel Electrodes and Rods; AWS A5.28
3. Flux Core-Arc Welding-Gas Shielding (FCAW-G): Welding electrodes for semiautomatic FCAW-G shall have a maximum H8 series level of diffusible hydrogen and conform to the Specification for Low-Alloy Steel Electrodes; AWS A5.29
4. Flux Core-Arc Welding-Self Shielding (FCAW-S): Welding electrodes for semiautomatic FCAW-S shall have a maximum H16 series level of diffusible hydrogen and conform to the Specification for Carbon Steel Electrodes; AWS A5.20
5. Submerged-Arc Welding (SAW): Bare electrodes and granular flux used in submerged-arc welding shall conform to F70 or F80 AWS flux classifications of the specification for Gare Mild Steel Electrodes and Fluxes for submerged-arc Welding, AWS A5.17.

6. Intermixing of welding processes shall not be permitted unless clearly indicated in Contractor's WPS submission. Contractor shall coordinate and submit for record all shop/field welding procedures, which overlap different welding process fusion zones
7. Alternate non-prequalified welding processes shall be considered based on Contractor qualifying test result submissions of Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR)

H. Headed Studs (shear connectors) shall be per Structural General Notes.

I. Deformed Bar Anchors shall be as specified in Structural General Notes.

J. Steel Castings shall conform to ASTM A27, Grade 65-35, medium strength carbon steel.

K. Grout: Refer to General Notes.

L. Post-installed Anchors shall be per Structural General Notes.

PART 3 - EXECUTION

3.1 PREPARATION

A. Work by Others: Examine all work prepared by others to receive work of this Section and report any defects affecting installation to Design Professionals. Commencement of work will be construed as complete acceptance of preparatory work by others. The Contractor alone shall be responsible for checking the dimensions and coordination of the structural steel work with other trades.

B. Anchor Rods: At least 20 working days prior to the start of the structural steel erection, the Contractor shall ascertain by accurate survey the existing location, alignment, and elevation of the anchor rods embedded in the concrete by others. The Contractor shall immediately notify the Design Professionals of any discrepancies observed between the Contract Documents and the as-built conditions. Steel erection shall not start until corrective measures, if required, have been performed.

3.2 FABRICATION

A. Fabricate and assemble structural steel in the shop to the greatest extent possible.

B. Tolerances:

1. Conform to the tolerances of the AISC "Code of Standard Practice," compensate for the difference between the temperature at time of fabrication and the mean temperature in service.
2. Elevator shafts used for temporary hoists shall conform to the detailed requirements of the hoist manufacturer.

C. Holes: Holes shall be provided in members to permit connections to the work of other trades or contracts, and for passage through the member of work of other trades. All holes shall be accurately drilled, cut, or punched at right angles to the surface of the metal in accordance with AISC Specifications. Thermally cut or water jet cut holes made with CNC equipment and that meet the requirements per both AISC and RCSC specifications are permitted. Thermally cut or water jet cut holes shall meet the surface roughness

requirements of ASME B46.1. Burning or drifting unfair holes will not be permitted. Holes that must be enlarged shall be reamed. Drift pins will be allowed only to bring together the several parts for connection. Holes in base plates are permitted to be drilled or thermally cut. Thermally cut holes in base plates shall meet the requirements of the AISC specification section M2.2. Holes shall be clean-cut without torn or ragged edges. Outside burrs resulting from drilling operations shall be removed with a suitable tool.

D. Camber: Provide camber as indicated on the Contract Documents. Where no camber is indicated, provide natural camber up.

E. Cutting: Manual oxyfuel or plasma cutting processes in the shop may be used only if automatic or semi-automatic methods are not possible. If manual shop cutting is required, it shall be done only with a mechanically guided torch, except that an unguided torch may be used where the cut is more than 1/2 inch (12mm) from the finished dimension and final removal is completed by means such as chipping or grinding to produce a gouge-free surface of quality equal to that of the base metal. At restrained joints and as indicated elsewhere, weld access holes shall be ground smooth to a bright metal finish.

F. Cutting of Heavy Sections: Where Heavy Sections are to be joined by partial or complete joint penetration welds in tension or require slots, copes, or blocking for connections, preheating shall be required for all thermal cutting operations except at holes and slots to receive bolts. Preheat shall be sufficient to prevent cracking but in no case less than 150 degrees F (65°C). Weld access holes, weld termination holes, blocks, and copes shall be ground to a bright metal finish and a smooth radius after cutting and tested for cracks by the magnetic particle method. All cut edges shall be free of sharp notches and gouges.

G. Anchor Rods: Rigid steel templates and anchor rods shall be furnished, labeled and shipped in sets indicating sizes and locations of columns, together with instructions for setting of anchor rods. Plate washers per Typical Details shall be provided.

H. Bolting: Bolts shall be driven accurately into the holes without damaging the threads. Bolt heads shall be protected from damage during driving. Bolt heads and nuts shall rest squarely against the metal. Where bolts are to be used on beveled surfaces having slopes greater than 1 in 20 with a plane normal to the bolt axis, beveled washers shall be provided to give full bearing under the head or nut.

I. Bolts indicated as “finger tight” on the Contract Documents shall be prevented from backing off by using lock nuts, thread compound or deformed threads.

J. Installation of High Strength Bolts:

1. Except where "snug tight" installation is specifically permitted on design Drawings, all high strength bolts shall be installed with full pretension using Turn-of-Nut Pretensioning, Twist-Off Type Tension Control Bolt Pretensioning or Direct-Tension-Indicator (DTI) Pretensioning in accordance with the "Specification for Structural Joints Using ASTM A325 or A490 Bolts".
2. Comply with special washer requirements of the RCSC, such as those related to slotted and oversize holes, and tapered flanges. DTI "washers" shall not be substituted for such required washers.
3. All high strength bolt assemblies (including Tension Control bolts and DTI’s) used in pretensioned connections shall be verified in accordance with the Pre-Installation Verification section of the RCSC.
4. Clean and re-lubricate bolts and nuts that become dry or rusty before use, except Tension Control bolts must be re-lubricated by manufacturer.

K. Welding of Structural Steel:

1. Pre-Weld Inspection: The surface to be welded and the filler material to be used shall be subject to inspection before welding is performed.
2. Welds indicated on the Contract Documents or the approved shop or erection drawings shall be created by electric arc welding processes that comply in all respects with the codes and specifications herein noted covering the design, fabrication, and inspection of welded structures and the qualifications of welders and supervisors. Control the heat input, weld length, weld sequence and cooling process to prevent distortion of the completed assembly.
3. Each welder's work shall be traceable.
4. Special Requirements: For High Restraint welds and welds at Heavy Sections, follow approved welding procedures for weld process, sequence, pre-heating and cooling. Use stress relieving techniques where shown in the approved procedure developed by the Contractor's Welding Consultant.
    a. Special Procedures: Prior to the start of production welding, the contractor shall demonstrate to the Testing Agency that preheat can be maintained without relying on heat from the arc. For field welding, the contractor shall provide a shelter to protect each joint from inclement weather (rain, snow, etc.), from start until completion of the joint.
    b. Preheat and Postheat: Preheat shall be sufficient to prevent cracking, but in no case less than required by AWS D1.1. The Contractor shall prepare a written welding sequence and distortion control plan to be included in the welding procedures submittal. Assembly sequence of adjoining parts shall balance applied induced heat from preheat and welding processes to minimize distortion and shrinkage. **[Complex]** Assemblies shall include special considerations to minimize significant shrinkage stress restraint in accordance with AWS D1.1, Annex H provisions. Under conditions of severe external shrinkage restraint, preheat temperature limitations for making welds shall be in accordance with AWS D1.1, Annex H, Table H2. Under conditions of severe external restraint, reduction of induced heat and cooling rate shall be monitored under the provisions of the Hydrogen Control/HAZ Hardness Control methods of AWS D1.1, Annex H. The preheat shall be maintained throughout the thickness of the material for a distance equal to twice the material thickness on both sides of the joint at a minimum. Where different thicknesses of steel are being joined, the greater thickness shall govern. Preheat shall be measured on the face opposite the side of the heat application. Preheat shall be applied uniformly in a manner that does not harm the surface of the material nor cause surface temperatures to exceed 1100 degrees F (600^{o}C). Should stress relief heat treatment be required, the contractor shall submit a written procedure.
    c. Prior to heat treatment on a production weld, prepare and treat a test sample per the Contractor's written procedure for tensile tests in accordance with ASTM requirements.

5. Welded Joint Details:
    a. Welding Backing: The use of weld backing shall be in accordance with AWS D1.1. Weld backing shall be removed where required by the Contract Documents or for the WPS by AWS D1.1.
    b. Weld Tabs:
        i. Use of Weld Tabs: Welds shall be terminated at the end of a joint in a manner that will ensure sound welds in accordance with AWS D1.1. Whenever necessary, this shall be done by use of weld tabs.
        ii. Heavy Section Joint Weld Tab Removal and Finish: All welded tension splices in Heavy Sections shall have the weld tabs removed and ground smooth.
        1)
    c. Weld Access Holes:

i. Weld access holes shall meet the dimensional, surface finish, and testing requirements of AISC 360 Chapter J1.6 and AWS D1.1, except as otherwise required by the Contract Documents.
ii. Weld access holes are defined for this project as any hole created in order to access a weld joint, facilitate the welding process, or relieve stresses due to weld shrinkage in a web, flange, or any other element of a steel shape.
1)

d. Welding for moment connections shall be sequenced so as to minimize residual stress in the joint.
e. Weld Termination Holes:
iii. Weld termination holes are defined for this project as any hole created in order to allow for weld termination or to relieve stresses due to weld shrinkage as part of the welding process.
iv. Re-entrant corners and/or internal radii of weld termination holes shall have a minimum radius of ½" or the thickness of the material divided by two, whichever is greater.

6. Deficient Welds: Welds found deficient in dimensions but not in quality may be enlarged by additional welding. Any weld found deficient in quality shall be removed by grinding or melting and the weld shall be remade.
7. Surface Roughness: Surfaces of weld access holes and weld termination holes in Heavy Sections shall be ground to a bright metal finish and inspected by Magnetic Particle Testing (MT) per the requirements of this specification.

L. Bearing:

1. Bearing ends of columns shall be milled or sawn square perpendicular to axis of the column, or at slope indicated in the Contract Documents.
2. Finish bearing areas of base plates per AISC M2.8.

M. Stiffeners: Fitted stiffeners shall be ground to fit closely against flanges.

N. Cleaning and Preparation of Steel Surfaces:

1. Clean all steel work in accordance with the Society for Protective Coatings (SSPC) Method specified herein that corresponds to its location and exposure. Steel work to be painted shall be painted within the same day that it is cleaned.
a. Interior, Not Exposed to View (above suspended ceilings, under sprayed-on fireproofing, steel to be encased in concrete): SSPC-SP-2, Hand Tool Cleaning.
b. Interior, Exposed in the Finished Building: SSPC-SP-6, Commercial Blast Cleaning, unless noted otherwise on the Drawings.
c. Exterior (exposed to weather or in unconditioned space): SSPC-SP-6, Commercial Blast Cleaning, unless noted otherwise on the Drawings.
d. Members to be Hot Dipped Galvanized: SSPC-SP3, Power Tool Cleaning, before galvanizing.

O. Shop Coating:

1. Where painting is specified, paint all steel work in accordance with the Society for Protective Coatings (SSPC) Method specified herein that corresponds to its location and exposure and in accordance with manufacturer's written instructions. Paint steel work the same day that it is cleaned.

a. Interior, Not Exposed to View (above suspended ceilings, under sprayed-on fireproofing, steel to be encased in concrete): No Paint.
b. Interior, Exposed in the Finished Building: SSPC – Paint 25
c. Exterior (exposed to weather or in unconditioned space): SSPC – Paint 20

2. Protect finished bearing surfaces with a rust-inhibiting coating which is to be removed immediately prior to erection.
3. Do not paint:
   a. Surfaces within six (6) inches (150mm) of field welds
   b. Surfaces to be encased in concrete or to receive cementitious fireproofing
   c. Contact surfaces of high-strength bolted Slip Critical connections (unless surface prep and paint has been specifically prequalified by the contractor or approved for use in this location by the SER)
   d. Surfaces required for testing and preheat, until all testing and preheat has been performed
   e. Finished bearing surfaces (use removable rust-inhibiting coating)
   f. Top flange of the beam where steel deck or headed studs are to be attached

4. Paint shall be applied thoroughly and evenly to dry surfaces only when surface temperatures are above dew-point, in strict accordance with manufacturer's instructions.
5. Surfaces of exterior members which are inaccessible after assembly or erection shall receive their second coat of the approved paint, in a different shade, in the shop.
6. Hot-dip galvanize the following steel members:
   a. All angles, steel plates and shims supporting exterior masonry or exposed to the weather, including shelf, arch and relieving angles
   b. All connections between the above angles and steel plates and the supporting structural member, including clip angles and hardware
   c. Any other steel members indicated as “Galvanized” on the Contract Documents.
   d. All miscellaneous metal, angles, clips, etc. on exterior masonry walls.

3.3 ERECTION

A. Tolerances: Erect all work plumb, square and true to lines and levels in strict accordance with the structural requirements of the building within tolerances of the AISC Code of Standard Practice, unless otherwise indicated on the Contract Documents. Compensate for the difference between the temperature at time of erection and the mean temperature in service.

B. Bracing: Brace the frame during erection in accordance with the Contractor’s erection procedure.

C. Errors: Immediately notify the Design Professionals of any errors in shop fabrication, deformations resulting from handling and transportation, and improper erection that affects the assembly and fitting of parts. Prepare details for corrective work and obtain approval of the method of correction. Approved corrections shall be made expeditiously at the sole expense of the Contractor.

D. Column Base Plates: Support and align on steel shims or setting bolts. After the supported members have been plumbed and properly positioned, tighten anchor rod nuts in preparation for grouting. Cut off wedges and shims flush with edges of plates and leave in place. The use of leveling plates will not be permitted without prior written approval by the SER. Contractor proposing the use of levelling plates shall provide documentation of plumbing procedure and remediation procedure for gaps between leveling plate and column base plate for SER review.

E. Grouting: Refer to General Notes. Grout base plates immediately after the first tier of columns are plumbed. Do not proceed with steel erection above the first tier until base plates are grouted.

F. Bolting and Welding of Structural Steel: See Section on "Fabrication".

G. Bearing Surface: Clean bearing surfaces and surfaces that will be in permanent contact before the members are assembled.

H. Splices: Splices will be permitted only where indicated on the Contract Drawings or the reviewed shop drawings. Fasten splices of compression members only after surfaces are cleaned and abutting surfaces have been brought completely into contact. Fill any remaining gaps with steel shims driven into place and cut flush. Tack weld shims to each other and to members. Use runoff tabs at bevel weld splices. Cut off runoff tabs and ground smooth after weld completion.

I. Driftpins: Driftpins may be used only to bring together the several parts, and shall not be used in such a manner as to distort or damage the metal. Correct poor matching of holes by drilling to the next larger size and using a larger size bolt. Plug welding and redrilling will not be permitted, unless a specific instance arises and is approved by the SER.

J. Erection bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces. On non-exposed welded construction, remove erection bolts.

K. Hammering: Hammering which may damage or distort the members will not be permitted.

L. Do not use cutting torches in the field without the specific approval of the SER for each application. Where cutting torch use is permitted, all the requirements of the Section on "Fabrication" shall apply.

M. Additional Material and Labor: If the Contractor furnishes additional material and labor for the purpose of erection or if the erection method requires that material be added to certain members, the required modifications shall be at the sole expense of the Contractor.

N. Alignment: Following erection, accurately align, level, and adjust all members prior to final fastening. Conform to AISC standard tolerances unless otherwise noted in the Contract Documents.

O. Touch-Up and Field Applied Paint: After erection, clean all damaged areas in the shop coat, exposed surfaces of bolts, bolt heads, nuts and washers and all field welds and unpainted areas adjacent to field welds according to manufacturers recommendations and paint with the same paint used for the shop coat. Match the touch up and field applied paint color to the as-built paint color. After touch up, at exterior (exposed to the weather or in unconditioned space) steel members apply a full coat of the specified paint in a different shade than the shop applied coat.

P. After erection, clean all damaged galvanized areas, welds and areas adjacent to welds and paint with the specified galvanizing repair paint.

Q. Clean all steel members of mud and debris and construction residue prior to erection.

R. Headed Studs and Deformed Bar Anchors:

1. End weld headed studs and deformed bar anchors with an automatic process in accordance with section 7 of AWS D1.1.

2. Areas to which studs are to be attached must be free of foreign material, such as rust, oil, grease, paint etc. When mill scale is sufficiently thick to cause difficulty in obtaining proper welds, remove by grinding or sand blasting.
3. Remove ceramic ferrules from studs and work after welding.
4. Replace any studs that crack or break. Only straighten studs that would foul other work or have less than 1 inch (25mm) cover in bent position.

3.4 CORRECTIVE MEASURES

A. Conflicts: The Contractor shall be solely responsible for errors of detailing, fabrication, and erection of structural steel, steel joists, and steel deck.

B. Compensation for Additional Services: Should additional work by Design Professionals such as design, documentation, meetings and/or site visits be required which are necessitated by failure of the Contractor to perform the work in accordance with the Contract Documents either developing corrective actions or reviewing corrective actions developed by others, the Contractor is responsible for paying for additional work performed by the Design Professionals at their standard firm-wide billing rates plus out-of-pocket expenses incurred at cost + 10%. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.

[Balance of page blank; see form on next page]

Structural Substitution Request Form – to be completed by Contractor

Project:		
Date:		Substitution Request #
Requesting Contractor:		Pages Attached (including this form)

1. Description of Requested Substitution:

2. Related Drawings and Specification Sections:

3. Rationale or Benefit Anticipated:

4. Effect on Construction Schedule[1] (check one): ☐ NONE ☐ See Attached

5. Effect on Owner's Cost[2] attach data (check one): ☐ CREDIT TO OWNER ☐ EXTRA

6. Effect on Construction Documents[3] (design work anticipated): ☐ NONE ☐ See Attached

7. Requesting Contractor Agrees to Pay for Design Changes (check): ☐ YES ☐ NO ☐ NOT APPLICABLE

8. Effect on Other Trades[4]:

9. Effect of Substitution on Manufacturer's Warranty (check): ☐ NONE ☐ See Attachment

Signature[5]: Date:

Company:

General Contractor Signature[5]: Date:

Notes:

1. Contractor is responsible for means and methods and any problems that may arise from making the requested substitution.
2. This is **NOT A CHANGE ORDER FORM**. A separate form is required to adjust costs and/or schedules.
3. Contractor is responsible for any design impacts that may arise from this substitution, including redesign efforts.
4. Contractor is responsible for effects on other trades from this substitution;
   General Contractor must review and agree effects on other trades are fairly represented in items 4-9.
5. Signature by a person having authority to legally bind his/her company to the above terms. Otherwise this request is void
6. All items in form must be completed for substitution request to be considered.

Request Review Responses (completed by Architect and/or Engineer(s)):

ACCEPTED	ACCEPTED AS NOTED	REJECTED	INSUFFICIENT DATA TO SUPPORT REQUEST	ENGINEER / ARCH / MEP SIGNATURE	DATE

Engineer/Architect Comments:

END OF SECTION

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SECTION 05 2000
STEEL JOISTS

PART 1 - GENERAL

1.1 GENERAL

Related Documents: Drawings and General Provisions of the Contracts, including the Division 1 Specification Section, apply to this section.

1.2 SCOPE

The work under this section includes design, fabrication and erection of open web steel joists and joist girders as indicated on the Drawings, complete with bridging, attached seats and anchors, joist substitutes compatible with joist seat depths at short spans, labor, accessories and services necessary for the installation of joists and related work.

The work shall include supplementary parts and members necessary to complete joist and joist girder work, regardless of whether such parts and members are indicated on the Drawings.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 4500
Cast-In-Place Concrete	Section 03 3000
Concrete Unit Masonry	Division 4
Structural Steel	Section 05 1200
Steel Deck	Section 05 3000
Miscellaneous Metals	Division 5
Fireproofing	Division 7
Painting	Division 9

1.4 CODES AND STANDARDS

A. Building Code: Work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards: See Section 05 1200 and the following:

1. Steel Joist Institute (SJI) - Standard Specifications for Open Web Steel Joists, SJI-K.
2. SJI - Standard Specifications for Longspan Steel Joists, LH-series and Deep Longspan Steel Joists, DLH-series, SJI-LH/DLH.

3. SJI – Standard Specifications for Joist Girders, SJI-JG.
4. SJI – Code of Standard Practice for Steel Joists and Joists Girders.

C. Definitions:

1. See Section 05 1200.

1.5 CONTRACTOR QUALIFICATIONS

A. See Section 05 1200.

B. Steel Joist manufacturer: Shall be a member of the Steel Joist Institute.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested.

1. Submittal Schedule
2. Shop Drawings and Erection Drawings
3. Submittal Letter
4. Certificate of Compliance

5. Submittal Schedule: See Section 05 1200
6. Shop Drawings and Erection Drawings: Submit for action
   a. Design calculations showing loads and other design criteria used for design of the joists and joist girders, bridging details for conditions not addressed by SJI standard bridging details, and connection details for field splices, for joist headers and for connections not addressed by SJI standard connection details. Calculations shall include a cover letter sealed and signed by a Professional/Structural Engineer licensed in the state where the project is located for joists to meet the design load requirements indicated on the plans.
   b. A complete set of Shop Drawings using standard designations and showing sizes, configurations, profiles, coding, camber, provision for, bridging, connections and attachments, surface preparation and finishes including primer product description and manufacturer. Show design loads and calculation references.
   c. A complete set of Erection (Joist Placement) Drawings using standard designations, showing joist, joist girder and joist header design loads, sizes, cambers, spacing, locations, connections and supports; coding; bridging sizes, locations, connections and attachments; field splices: and surface preparation and finishes, including primer product description and manufacturer. For all non-SJI standard joists, also show custom configurations, profiles and deflection criteria for live and total loads.

7. **Submittal Letter:** Joist manufacturer shall submit for record a letter accompanying the design calculations signed by their Engineer stating that they have received all structural steel Specification sections and have prepared their work in accordance with these Specifications.
8. **Certificate of Compliance:** Upon completion of fabrication, the steel joist manufacturer shall submit for record a signed certificate of compliance stating that the work was performed in accordance with

approved construction documents and with SJI Standard Specifications and that all material meets the specified requirements.

B. Submittal Process: See Section 05 1200.

C. Submittal Review: See Section 05 1200.

D. Substitution Request: See Section 05 1200.

E. Request for Information (RFI): See Section 05 1200.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect steel joists and accessories in transit, in storage, while handling and during erection.

B. When stored at site, store steel joists above ground on platforms, pallets, skids, trailers, or other supports. Keep joists free of dirt and other foreign matter.

C. Support steel joists in such a manner as to prevent distortion of members and injury to shop paint.

1.8 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. See Section 01 4500.

1.9 QUALITY CONTROL BY CONTRACTOR

A. See Section 05 1200.

B. Manufacturer shall maintain a quality control manual containing manufacturing tolerances (sweep, camber, depth, length, components locations, standard welding requirement, other fabrication requirements, etc.). Quality control manual shall be made available to the Owner's Testing Agency for review and use.

C. Manufacturer shall inspect joists to extent he deems necessary to assure fabrication is in accordance with Drawings, Specifications and manufacturer's design calculations, including the following:

1. Visually inspect welds to assure that size, length, and location of welds are in accordance with submitted shop drawings and details of welded connections.
2. Observe joint preparation assembly practices, welding techniques and performance of welding to assure that welding work is being performed in accordance with written welding procedures.
3. Test weld performance at random intervals. Pull test welds at light joists; if any fail, reinforce all welds made in that lot. Bend test welds at larger chords, at least 5% of welds and at every size change; if any fail, reinforce or repair all welds in that lot.
4. Check joists for over-all length, depth, camber, sweep, components size, locations and materials etc. to assure dimensions conform to tolerances specified herein and manufacturer's quality control manual.
5. Visually inspect painting of joists to assure appearance is in accordance with Contract Documents.
6. Randomly test paint thickness of joists to assure paint meets dry film thickness requirements.

D. Issue reports of inspections to Owner's Testing Agency prior to shipping joists.

1.10 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. See Section 05 1200.

1.11 PERMITS AND WARRANTY

A. See Section 05 1200.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL JOISTS:

A. Acceptable Manufacturers:

1. Vulcraft Div., Nucor Corp.
2. The New Columbia Joist Company, SMI.
3. Canam United States, Canam Group
4. New Millennium Building Systems

B. All joists shall be designed:

1. In accordance with the SJI Standard Specifications except as noted herein.
2. In the configurations shown on the Contract Documents.
3. To resist the loads and forces listed on the Contract Documents.
4. To meet deflection limits as listed on the Contract Documents
5. To consist of rolled shapes (or bent angle chords up to ¼ inch thick), not bent plate 'hat sections.'
6. With all joist components meeting the requirements of the SJI Standard Specifications, except as defined in this Specification.

C. Materials and Types:

1. All material shall be structural steel meeting the requirements of the joist design. Mill Test Reports shall be available for and traceable to all materials used.
2. Open Web Joist Members: SJI standard types, as indicated on the Drawings.
3. Joist Girders

D. Standard Primer: Unless specifically defined otherwise, Use manufacturers Standard Primer in dipped application, conforming to SSPC-Paint 15, or manufacturer's standard shop primer meeting the performance requirements of this primer.

E. Surface preparation – SSPC-SP2 or SSPC-SP3 minimum, unless higher surface preparation standard is required by coating manufacturer's minimum recommendation.

F. Fabrication:

1. Design and fabricate steel joists including headers and other supplementary framing; follow SJI Standard Specifications, except as noted in this Specification.
2. Fabricate joist with SJI standard camber, except where the design Drawings call for specific camber or for un-cambered geometry. At joists adjacent to rigid framing, design with greater stiffness and reduced camber indicated on Drawings for deck transition.
3. Provide bottom and top joist chord extensions as required.
4. Provide sloping shoes or beveled ends where required to provide full bearing of sloping joists or on sloping bearing surfaces.
5. To support point loads where shown on the Contract Documents, if a custom web pattern is specified, lay out joist panel points to occur at locations coinciding with the point loads.
6. To support point loads where shown on the Contract Documents, if a standard web pattern is permitted, provide web stiffeners/struts to deliver point loads to panel points.
7. Prepare and shop prime joists. Do not prime surfaces to be field welded or in contact with concrete or cementitious fireproofing materials.
8. See Drawings for additional bridging requirements that may affect bridging locations and/or configurations.

PART 3 - EXECUTION

3.1 ERECTION

A. Joist Installation:

1. Coordinate placement of anchors in concrete and masonry construction for securing bearing plates. Coordinate attachment holes in structural steel members.
2. Do not install joists until supporting work is in place and secured. When supporting structure is a grouted masonry wall, or cast-in-place concrete, the supporting material shall attain at least 75% of the specified compressive strength prior to joist installation.
3. Erect steel joists following SJI Standard Specifications
4. Bear joists on supports following SJI Standard Specifications
5. Space joists as indicated on Contract Documents
6. Laterally brace joists adequately during erection following SJI recommendations
7. After placing steel joists on supporting work, but before permanently fastening, adjust and align in accurate location and spacing, shimming as required to keep top chords at proper elevation,
8. Where the design requires bottom chord extensions to be connected, do not attach joist bottom chord extensions until all dead load is in place.
9. Permanently fasten joists to supporting work, install permanent bridging and inspect erected framework before any construction or dead loads are applied.
10. During erection period, provide means for adequate distribution of concentrated loads so that load carrying capacity of any joist is not exceeded
11. Do not field cut or alter joists without engineering direction of the joist manufacturer, and written approval of Design Professional.

B. Bridging Installation:

1. As a minimum, provide horizontal and/or diagonal type bridging for joists, complying with SJI Standard Specifications, including bridging designed and located to satisfy uplift loads indicated on the Drawings.

2. Install bridging immediately after erection and before construction loads are applied.
3. Bridging shall support top and bottom chords against lateral movement during construction period and hold joists in locations indicated on Drawings.
4. Connect bridging to joists by welding or mechanical means, with connections capable of resisting a minimum horizontal force in accordance with SJI. Do not tack weld bridging to joists or supports. Use fillet welds with a length of four (4) times weld throat thickness, or use length of weld divided by four (4) to determine usable throat thickness.
5. Bolt rigid x-bracing at intersection of two angles between joists.
6. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams as indicated on Drawings and in SJI Standard Specifications.

3.2 FIELD TOUCH-UP PAINTING

A. After erection, inspection and acceptance of erected joists, touch up damaged shop paint, repaired welds, rust spots and field connections.

B. Field touch-up paint shall be the same as that used in shop painting of joists.

3.3 CORRECTIVE MEASURES

A. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in Part 3 – CORRECTIVE MEASURES section of Specification 05 1200.

END OF SECTION

SECTION 05 3000 - STEEL DECK

PART 1 - GENERAL

1.1 GENERAL

Work of this Section shall conform to the requirements of Drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions and Division 1 Specification sections.

1.2 SCOPE

The work covered by this Section shall include all labor, material, equipment, permits, engineering and other services necessary for the design and installation of composite and non-composite structural steel floor deck systems, steel roof deck systems and related work with all attachments, flashings, metal closures, concrete stops, accessories and fittings as required for a complete installation in accordance with the Drawings and as specified herein.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

Submittals	Division 1
Quality Control	Division 1
Quality Assurance: Structural Testing and Inspection	Section 01 4500
Concrete	Section 03 3000
Structural Steel	Section 05 1200
Steel Joists	Section 05 2000
Miscellaneous Metals	Division 5
Fireproofing	Division 7
Painting	Division 9

1.4 CODES AND STANDARDS

A. Building Code: Steel deck work shall conform to the requirements of the Building Code identified on the Structural General Notes, and OSHA requirements, except where more stringent conditions or criteria occur in the standards referenced below and on the Drawings.

B. Standards:

1. All steel floor and roof deck manufacturers shall be listed in the Underwriter's Laboratories "Fire Resistance Index of Companies".
2. American Iron and Steel Institute (AISI) “Specification for the Design of Cold-Formed Steel Structural Members”.
3. American Welding Society AWS D1.3 , “Structural Welding Code – Sheet Steel.”
4. American Society for Testing and Materials "ASTM Standards in Building Codes", various standards as referenced herein.

5. Steel Deck Institute (SDI) “Design Manual for Composite Decks, Form Decks and Roof Decks”.

C. Definitions:

1. See Section 05 1200.

1.5 STEEL DECK MANUFACTURER AND CONTRACTOR QUALIFICATIONS

A. The Manufacturer and the Steel Deck Erector (“Erector”) shall each demonstrate a minimum of ten (10) years of experience with the specified steel deck systems.

B. The Erector shall use prequalified welding processes in accordance with the AWS Structural Welding Code and shall provide certification that those welders to be employed in the Work are currently qualified for those processes and have satisfactorily passed the applicable AWS qualification tests.

C. Contractor’s Engineer shall be qualified to perform the type of work required by the project. The Engineer shall be a [Professional/Structural] Engineer licensed in the state where the project is located. The Contractor’s Engineer shall have 10 years of experience in responsible charge of work of this nature, on steel deck installations similar to this Project in material, design, and extent, with a record of successful in-service performance. Proposed Contractor’s Engineer shall be subject to approval of Design Professionals and Owner.] [The Engineer shall be a Professional Engineer licensed in the state where the project is located.

1.6 SUBMITTALS

A. Required Submittals - Where the SUBMITTALS section of this Specification is in conflict with Division 1 Submittals, the more stringent requirements for the Contractor apply. Required submittal items are listed here; see below for detailed requirements. Do not submit items not requested.

1. Submittal Schedule
2. Calculations, Shop Drawings and Erection Drawings
3. Manufacturer’s Certification
4. Manufacturer’s Installation Instructions
5. Welder Certifications
6. Research Reports or Evaluation Reports

7. **Submittal Schedule**: The Steel Deck Contractor shall submit for action a schedule of drawing and calculation submissions at least twenty (20) working days prior to commencing submission of drawings and calculations. The schedule will indicate the number of drawings and calculations proposed to be submitted each week. Any modifications to the schedule shall be submitted for approval at least twenty (20) working days prior to modification is proposed to take place.
8. **Calculations, Shop Drawings and Erection Drawings** (including Field Work Drawings): Submit for record manufacturers standard load tables and calculations for items designed by the Contractor’s Engineer including substitution requests. Submit for approval shop drawings and erection drawings for all steel deck indicated on the Contract Documents.
    a. Materials shall not be fabricated or delivered to the site before the shop drawings have been approved or approved as noted by the Design Professionals and returned to the Contractor.

b. Submit for record, prior to or with shop drawings, calculations for items designed by the Contractor's Engineer. Calculations shall address all design gravity, uplift, and in-plane diaphragm loads indicated. Each calculation package shall be sealed and signed by the Contractor's Engineer.

c. Shop Drawings shall clearly indicate:

i. Deck types (profiles), steel gauges, and deck finishes.
ii. Deck layout, including panel locations, number of deck spans per panel, structural support locations and joint locations.
iii. Deck dimensions and sections keyed to layout plans, including side and end details and bearing requirements.
iv. Deck fastener types (welds, screws, pins, proprietary systems) and layout patterns at panel sides, ends and interior supports.
v. Deck manufacturer, profiles, properties, vertical load capacity and in-plane diaphragm shear capacity for all as-detailed conditions.
vi. Details and locations of accessories including hardware, framing reinforcement anchorage, sump pans, cant strips, ridge plates, valley plates and closure plates.
vii. Fabrication necessary to incorporate steel deck into the job.
viii. Correlation with other requirements, openings and flashings.
ix. Fully dimensioned layout of field-installed headed studs (shear connectors).
x. Contractor-coordinated openings for mechanical, electrical, plumbing, fire protection and other trades.

d. A letter shall be submitted along with the shop drawings. It shall bear the registration number seal, signature and address of the [Professional/Structural] Engineer who prepared or supervised the calculation and reviewed the shop drawing submittal and shall include the following: "The steel deck calculations have been developed for this project and are designed by me, or by qualified personnel under my direct supervision, to resist the loads and reactions indicated on the Contract Documents. I have reviewed the steel deck layout drawings and they comply with assumptions used to develop the steel deck calculations."

e. The Contractor shall have reviewed and approved the shop drawings prior to submission to the Design Professionals for their review, representing that the Contractor has verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog number and similar data with respect thereto and reviewed or coordinated each drawing and sample with the work of other trades and with the requirements of the project and the Contract Documents.

9. **Manufacturer's Certification**: Submit for record a letter of certification from the deck manufacturer stating that the design, the detailing and fabrication of the steel deck to be installed under this Section are in accordance with the SDI Design Manual for Composite Decks, Form Decks and Roof Decks.
10. **Manufacturer's Installation Instructions**: Submit for record Manufacturer's literature providing recommended installation instructions.
11. **Welder Certifications**: Submit for record welder certificates signed by the Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
12. **Research or Evaluation Reports**: Submit for record research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence steel deck's compliance with the building code in effect for the Project.

B. Submittal Process: See Section 05 1200.

C. SER Submittal Review: See Section 05 1200.

D. Substitution Request: See Section 05 1200.

E. Request for Information (RFI): See Section 05 1200.

1.7 COORDINATION AND TEMPORARY SUPPORT

A. Consult and cooperate with Contractors for other trades whose work affects or is affected by work under this Section in order that all phases of the work are properly coordinated to avoid delays, errors, omissions, or damage to any part of the work.

B. Steel Deck Contractor shall inform General Contractor of any special support requirements such as shoring of deck for wet concrete loads.

C. General Contractor shall coordinate with Steel Deck Contractor regarding any construction loads on deck before concreting, and on completed deck in excess of the design loads shown. Such conditions may include both gravity and lateral loads.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not bend or mar decking.

B. Store off ground with one end elevated for drainage.

C. Cover decking with waterproof material, ventilated to avoid condensation.

D. Do not store deck bundles on framing unless material is securely tied down and the framing has been analyzed to ensure that such storage will not cause an overload.

1.9 STRUCTURAL STEEL PRE-ERECTION CONFERENCE

A. See Section 05 1200.

1.10 QUALITY ASSURANCE BY OWNER'S TESTING AGENCY

A. See Section 01 4500.

1.11 QUALITY CONTROL BY CONTRACTOR

A. See Section 05 1200.

1.12 OBSERVATIONS AND CORRECTIONS BY DESIGN PROFESSIONALS

A. See Section 05 1200.

1.13 PERMITS AND WARRANTY

A. See Section 05 1200.

PART 2 - PRODUCTS

2.1 GENERAL

The work specified herein is based on the products of [Vulcraft] [Wheeling] [Verco Manufacturing Co.], in order to establish design quality and function in the installed work. Products of other manufacturers shall be subject to the approval of the Design Professionals. All steel deck units shall be of the same depth and profile as shown on the Drawings and the product of one manufacturer.

2.2 DESIGN

A. Section properties of the steel deck units shall be calculated in accordance with the AISI "Specification for the Design of Cold-Formed Steel Structural Members". The minimum positive and negative section moduli so obtained shall be used in calculations involving positive and negative moments, respectively, in determining the required gauges of steel deck units.

B. Where indicated on Drawings or Structural General Notes, the Contractor's Engineer shall design the steel deck using the load criteria shown on the Drawings and the design criteria specified herein.

C. The Contractor's Engineer shall be responsible for determining the suitability of single, double and multiple span lengths of decking for analysis under service and construction conditions.

D. Design of steel deck not receiving concrete fill:

1. Resist design loads using bare steel deck properties. Consider both construction loads and specified loads.
2. Use three span continuous layouts wherever possible.

E. Design of steel deck to receive concrete fill:

1. Design to work compositely with the concrete fill, unless otherwise specifically noted in the Contract Documents as 'form deck.'
2. Assume deck acts with hardened concrete in a simple-span mode unless otherwise specifically noted on the Contract Documents.
3. Resist superimposed dead and live loads indicated on Drawings, but not less than 150 psf (7.5kPa) superimposed load on composite slab.
4. Resist construction loads using bare steel deck properties.
5. Assume unshored construction unless shoring is specifically coordinated with the General Contractor prior to design.
6. Use three span continuous layouts wherever possible.

F. At spans where trenches cross steel deck, design the interrupted deck ends as noncomposite cantilevers capable of supporting a superimposed dead and live load of 150 psf (7.5kPa) excluding concrete fill, unless

greater load capacity is required by the Contract Documents. Increased deck gauge may be necessary to satisfy this loading condition.

G. Steel deck shall be approved by ICC or IAPMO for lateral shear resistance.

2.3 MATERIALS

A. Composite Steel Floor Deck

1. Galvanized Steel Deck: shall be formed from steel sheets conforming to ASTM A653, Structural Quality Grade 33 (minimum) with minimum yield strength of 33 ksi (230MPa). Before forming, the steel sheet shall be zinc coated conforming to ASTM A924, G60.
2. Phosphatized/Painted Steel Deck: shall be formed from steel sheets conforming to ASTM A1008 SS Grade 33 (minimum) with minimum yield strength of 33ksi (230MPa). Prior to painting, the steel shall be chemically cleaned and pre-treated. Following pre-treatment, the bottom side of deck shall be painted with high-heat, baked-on thermal setting primer.

B. Steel Roof Deck, Form Deck: shall be formed from steel sheets conforming to ASTM A653, Structural Quality Grade 33 (minimum) with minimum yield strength of 33 ksi (230MPa). Before forming, the steel sheet shall be zinc coated conforming to ASTM A924-G60. Roof deck indicated as acoustical deck shall have a minimum NRC rating of 0.70.

C. Floor decking shall be formed with integral locking lugs or embossments to provide a mechanical lock between the steel floor and the concrete slab sufficient to resist at least twice the design shear force. Minimum depth of embossments or locking lugs shall be .050"(1.3mm).

D. All steel decking shall be roll formed for uniformity in dimension and strength.

E. Floor and roof decking shall be classified by Underwriters' Laboratories, Inc. Each unit or bundle shall be labeled and marked as required by UL, indicating manufacturer, testing, and inspection.

2.4 ACCESSORIES

A. General: Provide accessory materials for steel deck that comply with requirements indicated and recommendations of the steel deck manufacturer.

B. Side Lap Fasteners: As indicated on the Drawings.][Manufacturer's standard, corrosion-resistant, hexagonal washer head; self-drilling, carbon steel screws, No. 10 minimum diameter.

C. Pour Stops and Girder Fillers: Steel sheet, of same material as deck panels, and of thickness and profile indicated, but not less than the deck gauge.

D. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material and thickness as deck panels, unless otherwise indicated.

E. Hanger Tabs: Manufacturer's standard UL rated piercing steel sheet hanger attachment devices for floor deck panels.

F. Recessed Sump Pans: Manufacturer's standard size, single piece steel sheet 0.071-inch (1.8mm) thick minimum, of same material as deck panels, with 1-1/2-inch (40mm) minimum deep level recessed pans and 3-inch (75mm) wide flanges. Cut holes for drains in the field.

G. Flat Receiver Pan: Manufacturer's standard size, single-piece steel sheet, 0.071" (1.8mm) thick minimum units, of same material as deck panels.

H. Miscellaneous Roof Deck Accessories: Steel sheet ridge and valley plates, finish strips, and reinforcing channels, of same material and thickness as roof deck unless otherwise indicated.

I. Headed Studs (shear connectors) shall be per Structural General Notes.

J. Steel Sheet Accessories: ASTM A 653, galvanized to G60 coating class conforming to ASTM A924.

K. Galvanizing Repair Paint: SSPC Paint 20 or MIL-P-21035, with dry film containing a minimum of 94% zinc dust by weight.

L. Flexible Rib Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

M. Sound-Absorbing Insulation: As required by the Contract Documents, provide manufacturer's standard premolded roll or strip glass fiber or mineral fiber.

2.5 SIDE JOINT HANGER SYSTEM for use in composite steel floor deck only

A. Provide hanger tabs along the side joints of units at 1'-0" (300mm) centers.

B. Side joint hanger tabs shall have a minimum allowable static load capacity of at least 100 lbs (45kg) and shall accommodate a flat bar hanger (no rod hangers).

C. All hangers, their installation, and tab activation shall be by trades requiring the tabs.

D. No plastered ceilings shall be hung from side joint hanger tabs.

E. No mechanical, electrical, plumbing or fire protection loads shall be hung from deck side joint hanger tabs.

2.6 MISCELLANEOUS MATERIALS

A. Arc-Welding Electrodes: AWS A5.1 E60XX or E70XX Series, as required for the conditions of use.

B. Touch Up Paint: use galvanized repair paint specified above.

C. Closure Tape as required to maintain cells clear of concrete at abutting panel ends.

PART 3 - EXECUTION

3.1 PREPARATION

A. Work by Others: Examine all work prepared by others to receive work of this Section, especially plan and elevation locations of supporting frames and walls. Report any defects affecting installation to Design Professionals. The Contractor alone shall be responsible for checking the dimensions and coordination of the steel deck work with other trades.

B. Do not place deck units on supports with debris or unapproved coatings that could affect full, level bearing and proper connections.

C. Do not place deck units on concrete supporting structures until concrete has cured and is dry.

D. Coordinate the location of decking bundles with a structural steel erector to prevent overloading of structural members.

3.2 ERECTION – PLACEMENT

A. Erect steel deck in accordance with the decking manufacturer's recommendations and the requirements of the Drawings and these Specifications.

B. Place steel deck on the supporting framework and adjust to final position with ends accurately aligned and bearing on supporting members before making permanent connections. Do not stretch or contract sidelap interlocks.

C. Place deck units flat, square, without warping or excessive deflections, in straight alignment for entire length of run of cells and with close alignment between the cells at ends of abutting units.

D. Abutting ends of deck panels shall occur over supports. End bearing shall be a minimum of 2 inches (50mm), or greater if required (web crippling) by deck manufacturer.

E. Where deck panels nest, laps shall be a minimum of 2" (50mm) and shall occur over supports. Nesting is permitted only where profiles are designed to nest and are fabricated with offset ends.

F. Install slab edge closures and pour stops at the theoretical position with maximum tolerance of + 3/8" (10mm). Closures and pour stops shall have adequate adjustments to maintain this tolerance while accommodating the structural steel frame tolerances.

3.3 ERECTION - CONNECTIONS

A. Connect steel deck to the steel framework at ends of units and at intermediate supports as shown on the Contract Documents and approved shop drawings.

B. Deck to support welds shall be puddle welds of diameter and spacing shown on Contract Documents and/or approved shop drawings.

C. Use welding washers for puddle welding at deck thinner than 22 gauge (0.85mm) and where recommended by the manufacturer

D. Where headed studs occur, if fused to deck for full weld perimeter each headed stud may be considered to replace one puddle weld

E. Fasten side laps and perimeter edges of panels between supports by button punching, side seam welding or screws, or as noted on Construction Drawings.

3.4 ERECTION – OPENINGS AND CLOSURES

A. Contractor to coordinate location of all openings with other trades (see Submittals).

B. Cut and install sleeves and holes through decking for openings indicated on the Architectural, Structural, and/or Mechanical-Electrical-Plumbing-Fire Protection Drawings. Cost shall be paid by the trade requiring such sleeves and holes. Sleeves will be furnished by the various trades requiring them. Provide and install reinforcement as required around sleeves. Where possible, leave deck intact and use block outs to hold back concrete at openings. Cut deck after concrete cures.

C. Provide miscellaneous headers and other steel reinforcing and supports welded to decking and structural steel as required at penetrations, around columns, etc. per typical details and manufacturer's recommendations.

D. Field cutting parallel to flutes shall be done in the low flutes, taking care to leave sufficient horizontal material to permit satisfactory welding of deck to supporting steel.

E. Openings required for work of other trades and not indicated on Architectural, Structural, Mechanical / Electrical / Plumbing / Fire Protection / Telecom Drawings shall be permitted only upon approval of the Design Professionals as to size and location.

F. Furnish and install tight-fitting closures at locations including but not limited to

1. Open ends of flutes and sides of decking (neoprene or sheet steel)
2. Open ends of all flutes at columns, walls and openings shown on Contract Drawings
3. Panel ends where panels change direction or abut (sheet steel or closure tape)
4. Between deck units and columns (sheet steel)
5. Between columns and exterior cladding (sheet steel)
6. Welding hole cover, with friction fastening, to close excess holes when required (sheet steel).

3.5 WELDING

A. Welding of steel deck shall follow the technique outlined by the steel deck manufacturer.

B. Welding of headed studs shall conform to all AWS requirements, including workmanship, quality control, and inspection, which shall be performed by the Contractor and observed by the Testing Agency.

3.6 ROOF SUMP PANS

Place over openings provided in roof decking and weld to top decking surface. Space welds not more than 12 inches (300mm) o.c. with at least one weld at each corner. Cut opening in roof sump bottom to accommodate drain size shown, coordinate with Plumbing Drawings.

3.7 CONCRETE PLACEMENT

A. Concrete with admixtures containing chloride salts or other deleterious materials shall not be used with steel deck.

B. Steel deck used to support concrete buggy runways shall be adequately protected against wheel damage. Decking and any runways or shoring shall be evaluated and designed by Contractor's Engineer.

3.8 TOUCH-UP

A. After installation touch-up welds on galvanized decking with specified galvanized repair paint to a dry film thickness of 2 mils, at all locations that will not receive concrete fill.

B. Touch-Up Painting: Where exposed to view, wire brush, clean, and paint scarred areas, welds, and rust spots on both surfaces of installed deck panels.

C. Touch up painted surfaces with same type of shop paint used on adjacent surfaces.

D. Where shop-painted surfaces are exposed in-service, apply touch-up paint to blend into adjacent surfaces.

3.9 CORRECTIVE MEASURES

A. Where the Contractor requests that the Design Professionals develop the corrective actions or review corrective actions developed by others, the Design Professional shall be compensated as outlined in Part 3 – CORRECTIVE MEASURES section of Specification 05 1200.

END OF SECTION

SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.
4. Soffit framing.

B. Related Requirements:

1. Section 05 5000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 09 2216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

1.3 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, licensed in the state where the project is located to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height.
    b. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft..
    c. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
    d. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft..
    e. Ceiling Joist Framing: Vertical deflection of 1/240 of the span for live loads and 1/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
    a. Upward and downward movement of 1/2 inch.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Wall Studs: AISI S211.
2. Headers: AISI S212.
3. Lateral Design: AISI S213.

D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade. ST33H for minimum base metal thickness of 0.0428 inch and less; ST50H for minimum base metal thickness of 0.0538 inch and greater.
2. Coating: G60, A60, AZ50, or GF30.

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G60.

2.3 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Depth: As indicated on drawings. unless indicated otherwise.
2. Minimum Base-Metal Thickness: As required by structural performance, but not less than 0.0329 inch.
3. Flange Width: As required by structural performance, but not less than 1-5/8 inches.
4. Section Properties: As required by structural performance.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As required by structural performance, but not less than 0.0329 inch.
2. Flange Width: 1-5/8 inches.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Depth: As indicated on drawings .
2. Minimum Base-Metal Thickness: As required by structural performance, but not less than 0.0329 inch.
3. Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

1. Minimum Base-Metal Thickness: As required by structural performance, but not less than 0.0329 inch.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

1. Flange Width: 1 inch plus twice the design gap.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Depth: As indicated on drawings. Minimum Base-Metal Thickness: As required by structural performance, but not less than 0.0329 inch.
2. Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. All soffits to be designed for uniform dead, live and components and cladding wind loading, as indicated on the drawings. Design shall include attachment to main building structural components.

2.7 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.8 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction,.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.9 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780/A 780M.

B. Cement Grout: Portland cement, ASTM C 150/C 150M, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

F. Sill Sealer Gasket/Termite Barrier: Minimum 68-mil nominal thickness, self-adhering sheet consisting of 64 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side.

1. Physical Properties:
   a. Peel Adhesion: 17.0 lb/in of width when tested in accordance with ASTM D412.
   b. Low-Temperature Flexibility: Pass at minus 25 deg F ASTM D146/D146M.
   c. Water Vapor Permeance: 0.05 perm maximum when tested in accordance with ASTM E96/E96M, Method B.
   d. Resistance to Termite Penetration: Comply with ICC-ES AC380.

2.10 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of (1/8 inch in 10 feet) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.2 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

E. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

G. Install insulation, specified in Section 07 2100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.3 INSTALLATION OF LOAD-BEARING WALL FRAMING

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: As shown on Shop Drawings.

B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

F. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

G. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

H. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

I. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

J. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF INTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 REPAIRS

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Field and shop welds will be subject to testing and inspecting.

B. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTION

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

END OF SECTION 05 4000

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SECTION 05 5000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for overhead doors.
3. Steel framing and supports for countertops.
4. Steel tube reinforcement for low partitions.
5. Steel framing and supports for mechanical and electrical equipment.
6. Steel framing and supports for applications where framing and supports are not specified in other Sections.
7. Elevator machine beams, hoist beams,.
8. Steel shapes for supporting elevator door sills.
9. Shelf angles.
10. Metal ladders.
11. Elevator pit sump covers.
12. Structural-steel door frames.
13. Metal bollards.
14. Dumpster enclosure gates.
15. Metal downspout boots.
16. Loose bearing and leveling plates for applications where they are not specified in other Sections.

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

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

C. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 04 2000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 05 1200 "Structural Steel Framing."
4. Section 05 5213 "Pipe and Tube Railings."
5. Section 05 7300 "Decorative Metal Railings."
6. Section 12 9300 "Site Furnishings" for bicycle racks.

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: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated-Design Submittal: 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 according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.5 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design ladders.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 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. Ferrous Metals:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
3. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

C. Nonferrous Metals:

1. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
2. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
3. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

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 B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.

B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 9113 "Exterior Painting." Section 09 9123 Interior Painting."

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. 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.

H. Thermoplastic Sleeves: See Drawings for requirements.

2.5 FABRICATION

A. General: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
2. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
3. Form exposed work with accurate angles and surfaces and straight edges.
4. Weld corners and seams continuously to comply with the following:
    a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    b. Obtain fusion without undercut or overlap.
    c. Remove welding flux immediately.
    d. At exposed connections, finish exposed welds and surfaces smooth and blended.
5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
6. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
7. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
8. 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.
9. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches from ends and corners of units and 24 inches o.c.

B. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

1. 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.
2. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on Shop Drawings.

C. Shelf Angles: 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.
3. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
4. Galvanize shelf angles located in exterior walls.

D. Metal Ladders: Comply with ANSI A14.3, except q for elevator pit ladders.

1. For elevator pit ladders, comply with ASME A17.1/CSA B44.
2. Steel Ladders:
   a. Space siderails 18 inches apart unless otherwise indicated.
   b. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
   c. Rungs: 1 by 1-inch- steel angle rungs in “V” orientation fitted in centerline of siderails, plug-welded, and ground smooth on outer rail faces. Fill rung with non-slip aluminum oxide filler.
   d. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
   e. Galvanize exterior ladders, including brackets.
   f. Prime interior ladders, including brackets and fasteners, with zinc-rich primer.

E. Elevator Pit Sump Covers: Fabricate from 1/8-inch plate with four 1-inch- diameter holes for water drainage and for lifting.

F. Miscellaneous Steel Trim: 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.

1. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
2. Galvanize exterior miscellaneous steel trim.

G. Metal Bollards: Fabricate metal bollards from Schedule 40 steel pipe.

1. Fabricate bollards for embedment in concrete footings.
2. Galvanize bollards after fabrication.

H. Metal Downspout Boots: Provide downspout boots made from cast aluminum in 30 inch height indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.

1. Outlet: Vertical, to discharge into pipe.
2. Prime cast-iron downspout boots with zinc-rich primer.

I. Dumpster Enclosure Gates: As follows:

1. Main Posts: 6-inch concrete-filled schedule 40 steel pipe. . Provide with sealed top cap welded in place and ground smooth.
2. Frame: 2 by 2 by 0.125-inch hot-dip galvanized steel tubes.
3. Rough Hardware: 1/4-inch hot-dip galvanized steel plate, weld to post and gate. Provide hinges with stainless steel pins.
4. Gate Panel Skin: Acoustical roof deck. Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
5. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, zinc coating.
6. Deck Profile: Type WR, wide rib.
7. Profile Depth: 1-1/2 inches.
8. Design Uncoated-Steel Thickness: 0.0358 inch.
9. Side Laps: Overlapped.
10. Slats: 1/4-inch thick by 4-inch wide aluminum at 4-1/2 inches o.c.
11. Hot dip galvanize after fabrication.
12. Finish: Powder-coat, black color.

J. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

1. Finish: Leave unfinished.

K. Loose Steel Lintels: 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.

1. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
2. Galvanize loose steel lintels located in exterior walls.

L. Q q Steel Weld Plates and Angles: 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.

2.6 FINISHES

A. General: Finish metal fabrications after assembly.

1. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

B. Steel and Iron Finishes:

1. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
2. 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.
   a. Shop prime with primers specified in Sections 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting" unless indicated otherwise.
3. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. 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.

C. Aluminum Finishes:

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

D. Stainless Steel Finishes: 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

A. General:

1. 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.
2. 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.
3. Field Welding: Comply with the following requirements:
   a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   b. Obtain fusion without undercut or overlap.
   c. Remove welding flux immediately.
   d. 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.
4. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
5. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

6. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   a. Cast Aluminum: Heavy coat of bituminous paint.
   b. Extruded Aluminum: Two coats of clear lacquer.

B. Installing Miscellaneous Framing and Supports: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

1. Anchor supports for operable partitions securely to, and rigidly brace from, building structure.
2. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
   a. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
   a. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

C. Installing Metal Bollards:

1. 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.
2. Fill bollards solidly with concrete, mounding top surface or provide precast top to shed water.
3. Install specified thermoplastic sleeves over metal bollards in accordance with manufacturer’s printed instructions.

D. Installing Bearing and Leveling Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

1. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 5000

SECTION 05 5113 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 HYPERLINK "http://contact.arcomnet.com/ContentContact.aspx?sect=055113&ver=06/01/17&format=SF&sid=13788" SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.

B. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Section 05 5213 "Pipe and Tube Railings" for pipe and tube railings.
3. Section 05 7300 “Decorative Metal Railings” for atrium stairway railings.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

1.3 ACTION SUBMITTALS

A. Product Data: For metal pan stairs and the following:

1. Abrasive nosings.
2. Shop primer products.
3. Grout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

C. Samples for Verification: For each type and finish of nosing.

D. Delegated-Design Submittal: For stairs,, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.

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

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

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 stairs, including attachment to building construction.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/720 or 1/4 inch, whichever is less.

2.2 METALS

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

B. Metal Materials:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25, unless another grade is required by design loads; exposed.
3. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30, unless another grade is required by design loads.

4. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 coating, structural steel, Grade 33, unless another grade is required by design loads.
5. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 ABRASIVE NOSINGS

A. Extruded Units: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Manufacturers:Subject to compliance with requirements, provide products by one of the following:
   a. ACL Industries, Inc.
   b. American Safety Tread Co., Inc.
   c. Amstep Products.
   d. Armstrong Products, Inc.
   e. Balco, Inc.
   f. Granite State Casting Co.
   g. Nystrom, Inc.
   h. Wooster Products Inc.

2. Basis-of-Design Product: Supergrit 2-Stage Stair Nosing Type WP-RN3SGProvide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
3. Nosings: Two-piece units, 3 inches wide, with subchannel for casting into concrete.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.4 FASTENERS

A. General: Provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 5 where built into exterior walls.

1. Select fasteners for type, grade, and class required.

B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941/F 1941M, 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 F 593, and nuts, ASTM F 594.

2.5 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Zinc-Rich Primer: Comply with SSPC-Paint 20, Type II, Level 2, and compatible with topcoat.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

D. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint with some undercutting and pinholes okay.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.

2. Locate joints where least conspicuous.
3. Fabricate joints that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.7 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Commercial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers as indicated on Drawings.
   a. Stringer Size: As indicated on Drawings.
   b. Provide closures for exposed ends of channel and rectangular tube stringers.
   c. Finish: Shop primed.

2. Construct platforms of steel channel or rectangular tube headers and miscellaneous framing members as indicated on Drawings.
   a. Provide closures for exposed ends of channel and rectangular tube framing.
   b. Finish: Shop primed.

3. Weld stringers to headers; weld or bolt framing members to stringers and headers.
4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.

1. Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.
2. Steel Sheet: Uncoated, cold -rolled steel sheet unless otherwise indicated.
3. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
4. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
5. Shape metal pans to include nosing integral with riser.
6. Attach abrasive nosings to risers.
7. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
   a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.8 FINISHES

A. Finish metal stairs after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

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

PART 3 - EXECUTION

3.1 INSTALLING METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.
    a. Clean bottom surface of plates.
    b. Set plates for structural members on wedges, shims, or setting nuts.
    c. Tighten anchor bolts after supported members have been positioned and plumbed.
    d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
    e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
        1) Neatly finish exposed surfaces; protect grout and allow to cure.
        2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.

F. Place and finish concrete fill for treads and platforms to comply with Section 03 3000 "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete.
2. Center nosings on tread width.

3.2 REPAIR

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 05 5113

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SECTION 05 5213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel railings for enclosed stairways and wall mounted railings in enclosed stairways.

B. Related Requirements:

1. Section 05 7300 "Decorative Metal Railings" for ornamental railings fabricated from pipes and tubes and guard-infill for atrium balconies and stairs.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. 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. Handrail brackets.
2. Shop primer.
3. Bituminous paint.
4. Nonshrink, nonmetallic grout.
5. Anchoring cement.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated-design professional engineer.

B. Welding certificates.

C. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings 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 railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
   a. Uniform load of 50 lbf/ ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:
   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
   b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 2-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL RAILINGS

A. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.

B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A36/A36M.

D. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.4 FASTENERS

A. Fastener Materials:

1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.

B. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

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.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast iron center of handrail 3-1/8 inches from face of wall.

B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

F. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.

G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water.

1. Provide weep holes where water may accumulate.
2. Locate weep holes in inconspicuous locations.

F. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

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 flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint

G. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

H. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

I. Form changes in direction as follows:

1. As detailed.
2. By bending.

J. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.

1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
2. Coordinate anchorage devices with supporting structure.

N. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

O. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 FINISHES

A. Steel and Iron Finishes

1. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.
2. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3.
   a. Exterior Railings: SSPC-SP 6/NACE No. 3.
   b. Railings Indicated To Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3.
   c. Other Railings: SSPC-SP 3.

3. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
   a. Shop prime uncoated railings with universal shop primer unless zinc-rich primer is indicated.
   b. Do not apply primer to galvanized surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

3.3 ANCHORING POSTS

A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete

with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

D. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:

E. Install removable railing sections, where indicated on Drawing, in slip-fit stainless steel sockets cast in concrete.

3.4 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends, using nonwelded connections.

C. Attach handrails to walls with wall brackets. Provide brackets with 2-1/2-inch clearance from inside face of handrail and finished wall surface.

D. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

E. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

3.5 CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 5213

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SECTION 05 7300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum decorative railings. For atrium balcony, atrium stairs and atrium wall mounted railings.

B. Related Requirements:

1. Section 05 5213 "Pipe and Tube Railings" for nonornamental railings fabricated from pipes and tubes.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of decorative metal railings assembled from standard components.
2. Handrail brackets.
3. Bituminous paint.
4. Nonshrink, nonmetallic grout.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated-design professional engineer.

B. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.

C. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

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 railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
   a. Uniform load of 50 lbf/ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:
   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
   b. Infill load and other loads need not be assumed to act concurrently.

3. Attachment to building structure. Refer to structural drawings for additional requirements and coordinate with the contractors involved.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.3 ALUMINUM DECORATIVE RAILINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Interna-Rail® aluminum component railing as manufactured and assembled by Hollaender Manufacturing or an approved equivalent. Single source manufacturer is required., or a comparable product by one of the following:

1. Blum, Julius & Co.., Inc.
2. C. R. Laurence Co., Inc.
3. Hollaender Mfg. Co.
4. Livers Bronze Co.
5. Newman; Hollaender Mfg. Co.
6. R & B Wagner, Inc.
7. Superior Aluminum Products Inc.

B. Source Limitations: Obtain each type of aluminum decorative railing components from single source from single manufacturer.

C. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

D. Extruded Bars and Shapes, Including Extruded Tubing: ASTM B221, Alloy 6063-T5/T52.

E. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.

1. Posts Alloy 6063-T5, Schedule 80
2. Rails Provide Alloy 6063-T6 Standard Weight (Schedule 40) pipe unless otherwise indicated.

F. Drawn Seamless Tubing: ASTM B210/B210M, Alloy 6063-T832.

G. Plate and Sheet: ASTM B209, Alloy 6061-T6.

H. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.

I. Castings: ASTM B26/B26M, Alloy A356.0-T6 or Almag 535.

J. Resin infill panels: Resin panels to be acrylic 3/8" thickness, from 3Form, see RSP on material selection schedule, Interiors Drawing Sheet I001.

2.4 FASTENERS

A. Fastener Materials:

1. Aluminum Railing Components: Type 304 stainless steel fasteners.
2. Dissimilar Metal Railing Components: Type 304 stainless steel fasteners.
3. Finish exposed fasteners to match appearance, including color and texture, of railings.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.

1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593 and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast-aluminum, center of handrail 3-1/8 inches from face of wall.

B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
2. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

2.6 FABRICATION

A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Connections: Fabricate railings with mechanical connections unless otherwise indicated.

C. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

D. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.

E. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

F. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings.

G. Form changes in direction as follows:

1. By flush bends or by inserting prefabricated flush-elbow fittings.

H. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

I. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.

J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other Work unless otherwise indicated.

K. Resin Infill Panels: Fabricate infill panels from resin made fromco-polyester resin.

1. Edge panels with U-shaped channels for stair railings made from metal sheet, 0.043 inch thick.
2. For balcony railings provide panels without channels. Provide U shaped aluminum brackets.

L. Toe Boards: Provide toe boards at railings around openings and at edge of open-sided floors and platforms:

1. Size; 4-inch high extruded section.
2. Clearance of Toe Plate Bottom Above Top of Walking Surface: 1/8 inch minimum and 1/4 inch maximum. Notch flanges as required at railing posts and post base plates.
3. Attach to each rail post with clamps which will allow for temperature expansion and contraction between posts.
4. Provide expansion joints in toeboard at railing expansion joints.
5. Provide pre-manufactured corners for field installation.

2.7 FINISHES

A. General Finish Requirements: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
2. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
3. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Aluminum Finishes:

1. Mechanical Finish: AA-M3x; sand top rails, handrails, and intermediate rails in one direction only, parallel to length of railing, with 120- and 320-grit abrasive. After installation, polish railings with No. 0 steel wool immersed in paste wax, then rub to a luster with a soft dry cloth.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Adjust railings before anchoring to ensure matching alignment at abutting joints.

C. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

3.3 ANCHORING POSTS

A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

D. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

E. Install removable railing sections, where indicated on Drawings, in slip-fit metal sockets cast in concrete.

3.4 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends, using nonwelded connections.

C. Attach handrails to walls with wall brackets. Provide brackets with 2-1/2-inch clearance from inside face of handrail and finished wall surface.

D. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.5 CLEANING

A. Clean aluminum by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

END OF SECTION 05 7300

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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.
2. Section 31 3116 "Termite Control" for site application of borate treatment to wood framing.

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.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.3 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:

1. 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.

F. Roof-Edge Nailer: Engineered wood nailer with adhered insulation as follows:

1. Available Manufacturers: Available manufacturers include, but are not limited to, PreBuck Engineered Framing Systems.
2. Engineered Nailer: LSL 1.30E Engineered Lumber, ICC ESR-1387, treated with zinc borate throughout complete cross section.
   a. Nailer Thickness: 1-1/2 inches, built-up as required.
   b. Meets AWPA U1-15 for Use Category 2 (UC2).

3. Insulation: Molded polystyrene board, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84, and preservative treated to resist termite degradation.
   a. Type: Type XIV, 40-psi .
   b. Insulation Thickness: 2 inches.
   c. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
   d. Thermal Resistivity: 4.2 deg F x h x sq. ft./Btu x in. at 75 deg F .

4. Insulation: Polyisocyanurate board insulation, ASTM C 1289, Type II, Class 1, Grade 3, felt or glass-fiber mat facer on both major surfaces.
   a. Compressive Strength: 24 psi .
   b. Insulation Thickness: 2 inches.
   c. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
   d. Thermal Resistivity: 5.9 deg F x h x sq. ft./Btu x in. at 75 deg F .

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.

2.7 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

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

SECTION 06 1600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Parapet sheathing.
3. Sheathing joint and penetration treatment.

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.

B. Shop Drawings: For air-barrier and water-resistant glass-mat gypsum sheathing assemblies.

1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly , 150 sq. ft., incorporating backup wall construction, window, storefront, door frame and sill, ties and other penetrations, and flashing to demonstrate crack and joint treatment and sealing of gaps, terminations, and penetrations of air-barrier sheathing assembly.
    a. Coordinate construction of mockups to permit inspection and testing of sheathing before external insulation and cladding are installed.
    b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
    c. If Architect determines mockups do not comply with requirements, reconstruct mockups until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

1. Type and Thickness: Type X, 5/8 inch thick.

2.3 PARAPET SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

1. Type and Thickness: Type X, 5/8 inch thick.

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 parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.

D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

2.5 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

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 wall and parapet sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with screws.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 1600

SECTION 06 4023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior millwork for Office and Library.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.
2. Section 06 4116 " Plastic-Laminate Faced Architectural Cabinets" for custom-fabricated cabinets to fit within and abut interior architectural woodwork.
3. Section 09 3000 "Tiling" for tile and cementitious backer applied to face of interior architectural woodwork.
4. Section 09 7200 "Wall Coverings" for acoustical wallcovering to be used over tackable substrate on interior face of interior architectural woodwork.
5. Section 12 3623.13 "Plastic-Laminate-Clad Countertops."
6. Section 12 3661.16 "Solid Surfacing Countertops."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For interior architectural woodwork.

1. Fully dimensioned shop drawings showing layouts and components, including edge conditions, joinery, terminating conditions, substrate construction, cutouts and holes, and provisions for attachment to substrates. Include elevations, section details, and large-scale details. Indicate color, pattern, and finish selections.
   a. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   b. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets and other items installed in architectural woodwork.
   c. Show grain direction of any surface materials.

C. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.
2. Solid Surface: 4 by 4 inches (100 by 100mm), for each type, color and pattern required.
3. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.
4. Tile: For each exposed product and for each color and texture specified, in manufacturer's size.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program.

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.

1. Shop Certification: AWI's Quality Certification Program accredited participant.

B. Installer Qualifications: AWI's Quality Certification Program accredited participant.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 INTERIOR ARCHITECTURAL WOODWORK, GENERAL

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

2.2 INTERIOR ORNAMENTAL WOODWORK FOR TRANSPARENT FINISH

A. Grade: Custom.

B. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

C. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Vertical Surfaces: Grade VGS.
3. Door and Drawer Edges: PVC edge banding, thick.
4. Other Edges: PVC edge banding, thick.
5. Pattern Direction: Horizontal, unless noted otherwise.
6.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.

1. MDF: ANSI A208.2, Grade 130.
2. Particleboard: ANSI A208.1, Grade M-2.
3.
4. Tackable Substrate: Homasote PINnacle 440 Panel Boards, or similar.

2.4 MISCELLANEOUS MATERIALS

A. Support Brackets: As indicated by manufacturer’s designations on drawings.

B.

C. Reveals, Corners, and Trims: As indicated by manufacturer’s designations on drawings.

D. Grommtets: As indicated by manufacturer's designations on drawings.
   a. Preservative Chemicals: Acceptable to authorities having jurisdiction[**and containing no arsenic or chromium**].
   b. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.

2. Fire-Retardant Treatment: Complying with requirements; provide [**where indicated**] <**Insert requirements**>.

E. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

F. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.5 FABRICATION

A. 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.

B. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition interior architectural woodwork to average prevailing humidity conditions in installation areas.

B. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

C. Install interior 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.

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates. Do not use face fastening or exposed fasteners.

END OF SECTION 06 4023

SECTION 06 4116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets that are not concealed within other construction.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
2. Section 12 3216 "Manufactured Plastic-Laminate-Faced Casework" for plastic-laminate casework of stock design.
3. Section 12 3623.13 "Plastic-Laminate-Clad Countertops."
4. Section 12 3661.16 “Solid Surface Countertops”.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plastic-laminate-faced architectural cabinets.

1. Include plans, elevations, sections, and attachment details.
2. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or fabricator's standard size.

D. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.
   a. Provide one sample applied to core material with specified edge material applied to one edge.

2. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Qualification Data: For Installer.

C. Quality Standard Compliance Certificates: AWI Quality Certification Program.

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.

1. Shop Certification: AWI's Quality Certification Program accredited participant.

B. Installer Qualifications: AWI's Quality Certification Program accredited participant.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

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

1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.

B. Grade: Premium.

1. Grade: [Premium] [Custom] [Economy].
2. <Double click to insert sustainable design text for regional wood materials.>
3. <Double click to insert sustainable design text for certified wood.>

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Vertical Surfaces: Grade VGS.
3. Door and Drawer Edges: PVC edge banding, 0.12 inch thick.
4. Other Edges: Grade VGS.
5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Materials for Semi-exposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
2. Surfaces Other Than Drawer Bodies: [High-pressure decorative laminate, NEMA LD 3, Grade VGS] [High-pressure decorative laminate, NEMA LD 3, Grade CLS] [Thermoset decorative panels].
   a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
   b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.

3. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued dovetail joints.

J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Plastic Laminate: As indicated by laminate manufacturer's designations on Drawings.
2. PVC Edgebanding; As indicated on Drawings.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.
2. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
2. Particleboard: ANSI A208.1, Grade M-2.
3. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch- thick metal, and as follows:

1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
2. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.

C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

D. Catches: Magnetic catches, BHMA A156.9, B03141.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

F. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

G. Drawer Slides: BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted.
2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
3. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
4. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.

H. File Rails

I. Door and Drawer Locks: Provide on all doors and drawers.

1. Door Locks: BHMA A156.11, E07121.
2. Drawer Locks: BHMA A156.11, E07041.
3. Key all doors and drawers within a room alike and each room differently.

J. Door and Drawer Silencers: BHMA A156.16, L03011.

K. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: As selected by Architect from Manufacturer’s full range.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Contact cement.

2.5 FABRICATION

A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 INSTALLATION

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

B. Grade: Install cabinets to comply with quality standard grade of item to be installed.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inchesusing concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with fasteners appropriate for substrate.
4. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with [No. 10 wafer-head screws sized for not less than **1-1/2-inch** penetration into wood framing, blocking, or hanging strips] [No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish] [toggle bolts through metal backing or metal framing behind wall finish].

END OF SECTION 06 4116

SECTION 06 4219 - PLASTIC-LAMINATE-FACED WOOD AND COMPACT- LAMINATE PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced wood paneling.Compact-laminate paneling.
2. Panel mounting system.
3. Metal reveals at plastic-laminate-faced wood paneling.

B. Related Requirements:

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

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:

1. Fully dimensioned shop drawings showing layouts and components, including edge conditions, joinery, terminating conditions, substrate construction, cutouts and holes, and provisions for attachment to substrates. Include elevations, section details, and large-scale details. Indicate color, pattern, and finish selections.
2. Include manufacturer's provided strike-off for custom graphic plastic-laminate facing.

C. Samples for Verification: For each type of exposed laminate, 8 by 10 inches.

1. Provide one Sample applied to core material[**and with specified edge material applied to one edge where applicable**].

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

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 DELIVERY, STORAGE, AND HANDLING

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

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where paneling is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support paneling by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.

C. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PANELING, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-faced wood paneling (decorative laminate surfacing) indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.2 PLASTIC-LAMINATE-FACED WOOD PANELING

A. Grade: Custom.

B. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3 and the following requirements:

1. Faces: Grade VGS.
2. Backs: Grade BKV.
3. Exposed Edges: Same as faces.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:

1. As indicated by manufacturer's designations on drawings.
2. Grain Direction: as indicated by custom graphic.

D. Panel Core: Fire-retardant particleboard or fire-retardant MDF.

1. Thickness: 3/4 inch.

E. Exposed Panel Edges: Legs of metal channels forming reveals.

1. Panel Reveals:
   a. As indicated by manufacturer's designations on drawings.

F.

G. Adhesives for Bonding Plastic Laminate: Unpigmented contact cement Contact cement PVA Urea formaldehyde or Resorcinol.

1. Adhesive used shall be consistent for face and back laminates to minimize warpage.
2. Adhesive for Bonding Edges: Hot-melt adhesive[**or adhesive specified above for faces**].

H. Fire-Retardant-Treated Paneling: Panels shall consist of fire-retardant plastic laminate and fire-retardant particleboard or fire-retardant, medium-density fiberboard (MDF). Panels shall have a flame-spread index of 25 or less and a smoke-developed index of 450 or less per ASTM E 84, and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

I. Assemble panels by gluing and concealed fastening.

2.3 COMPACT-LAMINATE PANELING

A. Composition: Decorative surface papers impregnated with melamine resins and pressed over kraft paper core sheets impregnated with phenolic resin. Sheets then bonded together under pressures greater than 1,000 lbs. per sq. in. and high temperatures approaching 300 deg F (149 deg C). Finished sheets trimmed and backs sanded to facilitate bonding to substrate.

1. Grade: Wilsonart Fire-Rated Grade: for applications where fire-rated properties are required.
2. Backs: Double-faced
3. Rating: Fire Rated Class A according to NFPA 101.

B. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:

1. As indicated by manufacturer's designations on drawings.
2. Grain Direction: Horizontal, unless noted otherwise on drawings.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

2.5 INSTALLATION MATERIALS

A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls.

B. Reveals, Corners, and Trims: As indicated by manufacturer's designations on drawings.

C. Installation Adhesive: Product recommended by panel fabricator for each substrate for secure anchorage.

2.6 FABRICATION

A. Complete fabrication, including assembly, to maximum extent possible, before shipment to Project site.

B. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition paneling to humidity conditions in installation areas.

B. Grade: Install paneling to comply with quality standard grade of paneling to be installed.

C. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.

D. Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening unless otherwise indicated.

END OF SECTION 06 4219

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SECTION 06 6116 - SOLID SURFACING FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid Surface window stools.
2. Solid surface wall caps.
3. Solid surface curb caps below stair railings.
4. Solid surface bench seats.

B. Related Sections:

1. Section 05 7300 “Decorative Metal Railings”.
2. Section 06 4023 “Interior Architectural Woodwork”
3. Section 06 4116 “Plastic-Laminate Faced Architectural Cabinets”.Section 12 3661.16 – “Solid Surfacing Countertops”.

1.2 ACTION SUBMITTALS

A. Product Data: For solid surfacing materials.

B. Shop Drawings: Show materials, finishes, edge profiles, and methods of joining.

C. Samples for Verification: For the following products:

1. Solid surface material, 6 inches square.

1.3 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of fabrications by field measurements.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL FABRICATIONS

A. Window Stools: Provide with minimum joints possible as follows:

1. Configuration: Provide window stools with the following configuration:
   a. Front: Straight, slightly eased at top.

2. Window Stools: 1/2-inch- thick, solid surface material.

3. Fabrication: Fabricate window stools with shop-applied edges unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

B. Wall Caps: Provide with minimum joints possible as follows:

1. Configuration: Provide wall caps with the following configuration:
   a. Front: Straight, slightly eased at top.

2. Wall Caps: 1/2-inch- thick, solid surface material.
3. Fabrication: Fabricate wall caps with shop-applied edges unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

C. Curb Caps: Provide with minimum joints possible as follows:

1. Configuration: Provide curb caps with the following configuration:
   a. Front: Straight, slightly eased at top.

2. Fabrication: Fabricate wall caps with shop-applied edges unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing. Pre-drill holes for railing system prior to attaching vertical uprights through solid surface curb.

D. Bench Seats: Provide with minimum joints possible as follows:

1. Configuration: Provide bench seats with the following configuration:
   a. Front: Straight, slightly eased at top.
   b. 1-1/2” built-up front edge made from three layers of ½” solid surface material.

2. Bench seats: 1/2-inch- thick, solid surface material with 1-1/2” built-up front edge.
3. Fabrication: Fabricate wall caps with shop-applied edges unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

MATERIALS

E. Certified Wood Materials: Fabricate countertops with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

F. Composite Wood and Agrifiber Products: Provide products that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

G. Particleboard: ANSI A208.1, Grade M-2 , made with binder containing no urea formaldehyde.

H. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

I. Adhesives: Adhesives shall not contain urea formaldehyde.

J. Adhesives: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

K. Solid Surface Material: (SSM) Homogeneous solid sheets of filled plastic resin complying with ANSI SS-1.

1. Product: As noted on Material Selection Schedule located on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all solid surface fabrications level to a tolerance of 1/8 inch in 8 feet.

B. Fasten window stools and wall/curb caps by adhering to substrate. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

END OF SECTION 06 6116

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SECTION 06 6400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic sheet paneling.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood furring for installing plastic paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories.

1.3 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319. Panels shall be USDA accepted for incidental food contact.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Crane Composites, Inc.; Glasbord (Basis of Design)
   b. Glasteel.
   c. Marlite.
   d. Newcourt, Inc.
   e. Nudo Products, Inc.
   f. Parkland Plastics, Inc.

3. Low-Emitting Materials: Paneling 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."

4. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 200 or less.
   b. Smoke-Developed Index: 450 or less.

5. Nominal Thickness: Not less than 0.09 inch.
6. Sheet Size: 4 feet x 8 feet.

2.2 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Adhesive: As recommended by plastic paneling manufacturer and with a VOC content of 50 g/L or less.

D. Adhesive: As recommended by plastic paneling manufacturer and that complies 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."

E. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 9200 "Joint Sealants."

1. Sealant shall have a VOC content of 250 g/L or less.
2. Sealant 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."

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

B. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

C. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.

3.2 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.

1. Drill oversized fastener holes in panels and center fasteners in holes.
2. Apply sealant to fastener holes before installing fasteners.

D. Install trim accessories with adhesive.

E. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

F. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 6400

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SECTION 07 1326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modified bituminous sheet waterproofing.
2. Blindside sheet waterproofing. (Elevator Pits)

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: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Carlisle Coatings & Waterproofing Inc; CCW MiraDRI 860/861.
   b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Bituthene 3000 or Bituthene Low Temperature.
   c. Polyguard Products, Inc.; Polyguard 650 Membrane.
   d. Tamko Building Products, Inc; TW-60.
   e. W. R. Meadows, Inc; Mel-Rol or Mel-Rol Low Temp.

2. Physical Properties:
   a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
   b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
   c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970/D 1970M.
   d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836/C 836M.
   e. Puncture Resistance: 40 lbf minimum; ASTM E 154/E 154M.
   f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
   g. Water Vapor Permeance: 0.05 perm maximum; ASTM E 96/E 96M, Water Method.
   h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.

3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.2 BLINDSIDE SHEET WATERPROOFING

A. Blindside Sheet Waterproofing for Vertical Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly; with the following physical properties:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Grace Construction Products; W.R. Grace & Co. -- Conn; Preprufe 160R.
   b. Polyguard Products, Inc; Underseal Blindside Membrane.

2. Physical Properties:
   a. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970/D 1970M.
   b. Peel Adhesion to Concrete: 5 lbf/in. minimum; ASTM D 903, modified.
   c. Lap Adhesion: 5 lbf/in. minimum; ASTM D 1876, modified.
   d. Hydrostatic-Head Resistance: 230 feet; ASTM D 5385, modified.
   e. Puncture Resistance: 100 lbf minimum; ASTM E 154/E 154M.
   f. Water Vapor Permeance: 0.1 perm maximum; ASTM E 96/E 96M, Water Method.
   g. Ultimate Elongation: 335 percent minimum; ASTM D 412, modified.

B. Blindside Sheet Waterproofing for Horizontal Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly; with the following physical properties:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Grace Construction Products; W.R. Grace & Co. -- Conn; Preprufe 300R.
   b. Polyguard Products, Inc; Underseal Underslab Membrane.

2. Physical Properties:
   a. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970/D 1970M.
   b. Peel Adhesion to Concrete: 5 lbf/in. minimum; ASTM D 903, modified.
   c. Lap Adhesion: 5 lbf/in. minimum; ASTM D 1876, modified.
   d. Hydrostatic-Head Resistance: 230 feet; ASTM D 5385, modified.
   e. Puncture Resistance: 200 lbf minimum; ASTM E 154/E 154M.
   f. Water Vapor Permeance: 0.1 perm maximum; ASTM E 96/E 96M, Water Method.
   g. Ultimate Elongation: 335 percent minimum; ASTM D 412, modified.

C. Mastic, Adhesives, and Detail Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

2.3 AUXILIARY MATERIALS

A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch, predrilled at 9-inch centers.

2.4 MOLDED-SHEET DRAINAGE PANELS

A. Molded-Sheet Drainage Panel: Comply with Section 33 4600 "Subdrainage."

B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel with Polymeric Film for Vertical Applications: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft..

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

3.2 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and per recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

E. Seal edges of sheet-waterproofing terminations with mastic.

F. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

3.3 BLINDSIDE SHEET-WATERPROOFING APPLICATION

A. Install blindside sheet waterproofing according to manufacturer's written instructions.

B. Place and secure molded-sheet drainage panels over substrate. Lap edges and ends of geotextile to maintain continuity.

C. Vertical Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation. Mechanically fasten to substrate.

1. Securely fasten top termination of membrane with continuous metal termination bar anchored into substrate and cover with detail tape.

D. Horizontal Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation.

E. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.

F. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.

G. Install sheet-waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.

H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.

3.4 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.5 PROTECTION, REPAIR, AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 1326

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SECTION 07 1900 - WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:

1. Cast stone.
2. Concrete unit masonry exposed to exterior at completion of construction.
3. Clay brick masonry.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

B. Samples: For each type of water repellent and substrate indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Applicator.

B. Product certificates.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

A. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 400 g/L or less of VOCs.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Conproco Corporation; Conpro Shield W20.
   b. Karnak Corporation; LL10.
   c. L&M Construction Chemicals, Inc; Aquapel.
   d. Pecora Corporation; KlereSeal 920-W.
   e. PROSOCO, Inc; Siloxane PD.

f. Rainguard Products Company; Blok-Lok.
g. SaverSystems; MasonrySaver All-Purpose Heavy-Duty Water Repellent.
h. Sika Corporation; Sikagard 701W.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in representative locations by method recommended by manufacturer.
2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
3. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

3.2 PREPARATION

A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.

B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.

C. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

D. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply coating of water repellent on surfaces to be treated using low-pressure spray to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

1. Cast Stone: At Contractor's option, first application of water repellent may be completed before installing units. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces. Remove masking after repellent has cured.

C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07 1900

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SECTION 07 2100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Glass-fiber blanket insulation.
4. Duct liner insulation for mechanical room walls

B. Related Requirements:

1. Section 07 5323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for insulation specified as part of roofing construction.
2. Section 09 2900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Research reports.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation: Maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, when tested in accordance with ASTM E 84.

1. Types and minimum compressive strengths per ASTM C 578 as follows:
   a. All Locations Unless Indicated Otherwise: Type X, 15-psi.
   b. Foundation: Type IV, 25-psi.
   c. Under Slabs Subject to Foot Traffic: Type VI, 40-psi.
   d. Under Slabs Subject to Vehicle Traffic: Type VII, 60-psi.

2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
3. Thermal Resistivity: 5.0 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.2 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

A. Polyisocyanurate Board Insulation, Foil Faced: ASTM C 1289, foil faced, Type I, Class 1 or 2.

1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.3 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation (interior walls for acoustics, concealed in stud space), Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, when tested in accordance with ASTM E 84; passing ASTM E 136 for combustion characteristics. Density: 0.6 to 1.0 lbs/cu. ft. R-3.2 per inch minimum.

1. Thickness: As follows unless indicated otherwise:
   a. Walls: 3-1/2 inches.

B. Glass-Fiber Board Duct Liner Insulation (for mechanical room walls where indicated on drawings, surface applied for acoustics), Unfaced: ASTM C 1071, Type II; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, when tested in accordance with ASTM E 84; passing ASTM E 136 for combustion characteristics. Density: 0.6 to 1.0 lbs/cu. ft. R-4 per inch minimum. NRC 0.95. 2-inch thickness.

1. Subject to compliance with requirements provide Johns Manville Linacoustic R-300.

2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

C. Low-Conductive Girts: Composite girts formed of glass strand rovings and continuous strand glass mats or stitched reinforcements in cured resin as follows:

1. Product: Subject to compliance with requirements, provide one of the following:
   a. Advanced Architectural Products, LLC; SMARTci GreenGirt.
   b. Armatherm Thermal Break Solutions; Armatherm Z Girt.

2. Depth: 3 inches .

3. Provide with splines for end joints of insulation.
4. Self-Extinguishing: Comply with ASTM D635.
5. Fastener Pullout: Minimum 450 lbs (204 kgs).
6. Tensile Stress: Provide engineered lengthwise and crosswise tensile stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D638.
7. Lengthwise Coefficient of Thermal Expansion: Maximum 7.0 x 10¯6 inch/inch/degrees F, in accordance with ASTM D696.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.2 INSTALLATION OF SLAB INSULATION

A. Provide extruded polystyrene in thickness indicated, or molded polystyrene or graphite-polystyrene foam-plastic board in increased thickness to provide an equivalent R value.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 48 inches in from exterior walls.
   a. Thickness: 3 inches unless indicated otherwise.

C. For in slab heat bidding alternate, install additional insulation as shown on drawings.

3.3 INSTALLATION OF FOUNDATION WALL INSULATION

A. Provide extruded polystyrene in thickness indicated, or molded polystyrene or graphite-polystyrene foam-plastic board in increased thickness to provide an equivalent R value.

B. Butt panels together for tight fit.

C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.
2. Thickness: 3 inches, R-15 minimum unless indicated otherwise.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install ribbons of adhesive on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Thoroughly fill joints between pieces of insulation as required to form complete air barrier.

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 PROTECTION

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

END OF SECTION 07 2100

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SECTION 07 2119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Closed-cell spray polyurethane foam.

B. Related Requirements:

1. Section 07 2100 "Thermal Insulation" for foam-plastic board insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product test reports.

C. Research reports.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 2.0 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.6 deg F x h x sq. ft./Btu at 75 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. BASF Corporation; Spraytite 81206 SPF.
   b. BASF Corporation; Walltite.
   c. Demilick USA LLC; HeatLok Soy.
   d. Henry Company; Permax 2.0X
   e. Icynene Inc.; ProSeal.
   f. Johns Manville; JM Corebond MCS.
   g. NCFI; InsulBloc.

h. Polymaster, Inc.; InsulBloc.

2. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
4. Water Absorption: Maximum 2.0 percent per ASTM D 2842.
5. Color: Provide black color at rainscreen systems.

B. Closed-Cell Gap-Sealing Insulation: Two-part polyurethane foam for filling cavities, penetrations, gaps, and similar spaces.

1. Products: One of the following:
   a. Dow Chemical Company (The); Froth-Pak.
   b. Polymaster, Inc.; Handi-Foam.

2. Thermal Resistance: Minimum 5.35 deg F x h x sq. ft./Btu x in. at 75 deg F per ASTM C 518 at 90 days.
3. Fire Resistance: Maximum flame spread of 25 and smoke developed of 450 when tested per ASTM E 84.
4. Nominal Density: 1.75 lb/cu. ft..

2.2 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

B. Low-Conductive Girts: Composite girts formed of glass strand rovings and continuous strand glass mats or stitched reinforcements in cured resin as follows:

1. Product: Subject to compliance with requirements, provide [**one of**] the following:
   a. Advanced Architectural Products, LLC; SMARTci GreenGirt.
   b. Armatherm Thermal Break Solutions; Armatherm Z Girt.

2. Depth: 4 inches.
3. Provide with splines for end joints of insulation.
4. Self-Extinguishing: Comply with ASTM D635.
5. Fastener Pullout: Minimum 450 lbs (204 kgs).
6. Tensile Stress: Provide engineered lengthwise and crosswise tensile stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D638.
7. Lengthwise Coefficient of Thermal Expansion: Maximum 7.0 x 10¯6 inch/inch/degrees F, in accordance with ASTM D696.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install girts in accordance with manufacturer’s written instructions and recommendations. Space girts at 16 inches on center.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

1. Total Thickness: 3 inches unless indicated otherwise.

D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.

E. Miscellaneous Voids: Apply according to manufacturer's written instructions.

F. Install girts to allow drainage in rainscreen systems.

G. Install foam to seal and adhere to girts as an effective water and weather barrier.

END OF SECTION 07 2119

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SECTION 07 4213.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal composite material (MCM) panels.
2. Metal composite material (MCM) systems.

1.2 DEFINITIONS

A. DBVC: Drained and back-ventilated cavity rainscreen system designed to drain and dry water entering cavity through drainage channels, weeps, and air ventilation.

B. MCM: Metal composite material; cladding material formed by joining two thin metal skins to polyethylene or fire-retardant core and bonded under precise temperature, pressure, and tension.

C. PER: Pressure-equalized rainscreen system designed for no water intrusion, with equal pressure within air cavity and outside cladding barrier.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings:

1. Include fabrication and installation layouts of MCM system; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, accessories, and special details.
2. Accessories: Include details of flashing, trim, and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
3. Provide signed and sealed drawings, by a qualified design professional in Project jurisdiction, of MCM system showing compliance with performance requirements and design criteria identified for this Project.

C. Samples: For each type of MCM panel and system indicated, with factory-applied color finishes.

D. Delegated Design Submittals: For MCM system, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each MCM panel, for tests performed by manufacturer and witnessed by a qualified testing agency.

a. MCM panel manufacturer's material test reports.

b. Fabricator's MCM system test reports.
1) DBVC System: Tested to AAMA 509.
2) PER System: Tested to AAMA 508.

2. Research reports.

B. Delegated design engineer qualifications.

C. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Warranty documentation.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Fabricator: Approved by MCM panel manufacturer.
2. Installer: Entity that employs installers and supervisors who are trained and approved by MCM system manufacturer.
3. Delegated Design Engineer: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.
4. Testing Agency: An agency acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver , store, and handle components, MCM panels, and other manufactured items so as not to be damaged or deformed. Package MCM panels for protection during transportation and handling.

B. Unload, store, and erect MCM panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack MCM panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store MCM panels to ensure dryness, with positive slope for drainage of water. Do not store MCM panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on MCM panels during installation.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of MCM panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

A. Coordinate MCM panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Panel Integrity Warranty: Manufacturer agrees to repair or replace components of MCM panels that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Panel Finish Warranty: Manufacturer agrees to repair finish or replace MCM panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period:5 years from date of Substantial Completion.

C. MCM System Warranty: System manufacturer's standard form in which manufacturer agrees to repair or replace components of MCM systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two 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 MCM system.

B. Structural Performance: MCM systems to withstand the effects of the following loads, based on testing in accordance with ASTM E330/E330M:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
4. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested in accordance with ASTM E283/E283M at the following test-pressure difference:

5. Test-Pressure Difference: 6.24 lbf/sq. ft..

C. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Provide DBVC system with V-axis classification number greater than or equal to W-axis classification number in accordance with AAMA 509.

E. 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 METAL COMPOSITE MATERIAL (MCM) WALL PANELS

A. Metal Composite Material (MCM) Wall Panels: Provide MCM panels fabricated from two metal facings bonded to a solid, extruded thermoplastic core.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ALPOLIC Materials; Mitsubishi Chemical Composites;.
b. ALUCOBOND; 3A Composites USA, Inc; ALUCOBOND PLUS.
c. Arconic;.

2. Sobotec SL-2000, Core: FR.
3. Panel Thickness: 0.118 inch.
4. Bond Strength: 22.5 in-lb/in. when tested for bond integrity in accordance with ASTM D1781.
5. Fire Performance: Flame-spread index less than 25 and smoke-developed index less than 450, in accordance with ASTM E84 or UL 723.

B. MCM Panel Materials:

1. Aluminum-Faced Panels: ASTM B209 alloy as standard with manufacturer, temper as required to suit finish and forming operations with 0.020-inch- thick, aluminum sheet facings.

a. Exterior Finish: Clear anodized.

2.3 METAL COMPOSITE MATERIAL (MCM) SYSTEM

A. DBVC MCM System: Provide factory-formed and -assembled, MCM panels formed into profile for DBVC system installation, drained at horizontal joints and at base of wall. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Citadel Architectural Products, Inc.;.
b. NorthClad Rainscreen Solutions;.
c. Protean Construction Products, Inc;.

d. SAF (Southern Aluminum Finishing Company, Inc.);.

B. System Panel Depth: As indicated on drawings.

C. Attachment Assembly Components: Manufacturer's standard formed from extruded aluminum.

D. Labeling: Comply with labeling requirement of applicable building code.

2.4 ACCESSORIES

A. Metal Subframing and Furring: ASTM C955 cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of MCM system.

B. System Accessories: Provide components required for a complete, weathertight wall system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of MCM panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as MCM panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent MCM panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Use gasketed or approved coated fasteners between dissimilar metals.

1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in MCM panels and remain weathertight; and as recommended in writing by MCM system manufacturer.

2.5 FABRICATION

A. Fabricate and finish MCM panels at the factory, by panel manufacturer's standard procedures and processes, as necessary to fulfill indicated panel performance requirements demonstrated by laboratory testing.

B. Shop-fabricate MCM systems and accessories by fabricator's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with requirements of MCM panel manufacturer, of indicated system profiles, and with dimensional and structural requirements.

1. Fabricate panels to dimensions indicated on Drawings based on an assumed design temperature of 70 deg F. Allow for ambient temperature range at time of fabrication.

2. Formed MCM panel lines, breaks, and angles to be sharp and straight, with surfaces free from warp or buckle.
3. Fabricate panels with sharply cut edges and no displacement of face sheet or protrusion of core.
4. Fabricate MCM panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
5. Attach routed-and-returned panel flanges to perimeter extrusions or panel clips with manufacturer's standard fasteners.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams.
4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. 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.

C. Anodized Aluminum Finish: Clear in accordance with AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, MCM system supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by MCM system manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by MCM system manufacturer.
    a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating MCM system to verify actual locations of penetrations relative to seam locations of MCM panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF MCM SYSTEM

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, MCM system supports, and other conditions affecting performance of the Work.

B. General: Install MCM system in accordance with system manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor MCM system securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving MCM system.
2. Flash and seal MCM system at perimeter of all openings. Fasten with self-tapping screws.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as MCM system work proceeds.
6. Align bottoms of MCM panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
7. Provide weathertight escutcheons for all items penetrating system.
8. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by MCM system manufacturer.
9. Attach MCM panels to supports at locations, spacings, and with fasteners recommended by manufacturer to meet listed performance requirements.

C. Attachment Assembly, General: Install attachment assembly required to support MCM panels and to provide a complete weathertight wall system, including tracks, drainage channels, anchor channels, perimeter extrusions, and panel clips.

1. Install subframing, furring, and other panel support members and anchorages in accordance with ASTM C955.
2. Install support system at locations, at spacings, and with fasteners recommended by MCM system manufacturer to meet listed performance requirements.

D. DBVC MCM System: Install vertical tracks and horizontal tracks at locations, at spacings, and with fasteners recommended by system manufacturer.

1. Attach MCM panels by interlocking panel clips into tracks.
2. Insert matching MCM spline into tracks at joint reveal locations.

E. Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install accessory components required for a complete MCM system assembly including trim, copings, corners, seam covers, flashings, sealants gaskets, fillers, closure strips, and similar items. Provide types indicated by MCM system manufacturer.

F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft. with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

G. Remove temporary protective coverings and strippable films as MCM panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by MCM panel manufacturer. Maintain in a clean condition during construction.

3.3 INSTALLATION TOLERANCES

A. Shim and align MCM panels within installed tolerance of 1/4 inch in 20 ft., non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration in accordance with AAMA 501.2.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed MCM system installation, including accessories.

D. MCM system will be considered defective if it does not pass test and inspections.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.5 CLEANING

A. Remove temporary protective coverings and strippable films as MCM panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by MCM panel manufacturer. Maintain in a clean condition during construction.

B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

3.6 PROTECTION

A. Replace MCM panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 4213.23

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SECTION 07 4293 - SOFFIT METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soffit Metal Wall Panels. (SMWP)

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: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

B. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. 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 (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METAL SOFFIT PANELS

A. Provide 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 in side laps. Include accessories required for weathertight installation.

B. Flush-Profile Soffit Metal Wall Panels (SMWP 1): [**Solid**] [**Perforated**] panels formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.

1. Subject to compliance with requirements provide the following:
   a. Pure + Freeform LLC, Soffit Metal Wall Panels

2. Aluminum Sheet: Coil-coated sheet, ASTM B209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
   a. Thickness: 0.040 inch.
   b. Surface: Smooth, flat finish.
   c. Exterior Finish: FEVE Fluoropolymer.
   d. Color: Autumn Cherry #AU021 (Woodgrain) .
   e. Texture/Gloss: As selected from full range of manufacturers standards.

3. Panel Coverage: 8 inches.
4. Panel Height: 0.75 inch .

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/8 inch thick.
2. Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. FEVE Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

1. Soffit Framing: Wire tie furring channels to supports, as required to comply with requirements for assemblies indicated.

3.2 INSTALLATION

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set

units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 07 4293

SECTION 07 5323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
2. Substrate board (at gymnasium acoustic metal deck only).
3. Roof insulation.
4. Cover board.
5. Walkways.

B. Section includes installation of sound-absorbing insulation strips in ribs of roof deck. Sound-absorbing insulation strips are furnished under Section 05 3100 "Steel Decking."

C. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 7100 "Roof Specialties" for roof edge flashings.
3. Section 07 9200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
4. Section 22 1423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preliminary Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For insulation and roof system component fasteners, include copy of SPRI's Directory of Roof Assemblies listing.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness if insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.

4. Tapered insulation, thickness, and slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane and fastening spacings and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Tie-in with air barrier.

C. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
   a. Submit evidence of complying with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Evaluation Reports: For components of roofing system, from ICC-ES.

D. Field Test Reports:

1. Concrete internal relative humidity test reports.
2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

E. Field quality-control reports.

F. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roofing membrane, all other items specified in this Section, flashings and counterflashings, coping and gravel stop, and other components of membrane roofing system.
2. Wind Speed: Warranty shall not have limitation for wind damage for wind speed less than 70 mph.
3. Warranty Period: 20 years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings shall remain watertight.

1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D 3746, ASTM D 4272, or the Resistance to Foot Traffic Test in FM Approvals 4470.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.

1. Wind Uplift Load Capacity: 75 psf.

D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

A. EPDM Sheet: ASTM D 4637/D 4637M, Type I, nonreinforced, EPDM sheet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Carlisle SynTec Incorporated.
   b. Firestone Building Products.
   c. GenFlex Roofing Systems.
   d. Johns Manville; a Berkshire Hathaway company.
   e. Versico Incorporated.

2. Thickness: 60 mils, nominal.
3. Exposed Face Color: Black.
4. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

2.3 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.

C. Protection Sheet: Epichlorohydrin or neoprene nonreinforced flexible sheet, 55 to 60 mils thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil. Apply within 6 feet of kitchen exhaust hood discharge.

D. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

E. Bonding Adhesive: Manufacturer's standard.

F. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- wide minimum, butyl splice tape with release film.

G. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

H. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

I. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

J. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.

K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

1. Provide white flashing accessories for white EPDM membrane roofing.

2.4 SUBSTRATE BOARDS

A. Substrate Board (Gymnasium only, at acoustic metal deck): ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum board or ASTM C 1278/C 1278M, fiber-reinforced gypsum board.

1. Thickness: Type X, 5/8 inch.

2.5 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured[or approved] by EPDM roof membrane manufacturer , approved for use in SPRI's Directory of Roof Assemblies listed roof assemblies.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Compressive Strength: 20 psi.
2. Thickness:
   a. Base Layer: 2-1/2 inches.
   b. Upper Layer: 2-1/2 inches.

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/4 inch.
3. Slope: As required to provide minimum roof slope of 1/4 inch per 12 inches unless otherwise indicated.

2.6 INSULATION ACCESSORIES

A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.

C. Cover Board: ASTM C 1289 Type II, Class 4, Grade 1, 1/2-inch- thick polyisocyanurate, with a minimum compressive strength of 80 psi.

1. Thermal Resistance: Minimum R 2.5.

2.7 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

1. Size: Approximately 36 by 60 inches
2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 3000 "Steel Deck."

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.

1. Submit test result within 24 hours of performing tests.
    a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

D. Install sound-absorbing insulation strips according to acoustical roof deck manufacturer's written instructions.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, SPRI's Directory of Roof Assemblies assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 07 2715 "Nonbituminous Self-Adhering Sheet Air Barriers." 07 2119 – Foamed-In-Place Insulation

3.4 SUBSTRATE BOARD INSTALLATION

A. At Gymnasium acoustic metal deck only. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.
    a. Locate end joints over crests of steel roof deck.

2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck according to recommendations in SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29.

5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.5 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.
    a. Locate end joints over crests of decking.
    b. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
    c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
        1) Trim insulation so that water flow is unrestricted.
    f. Fill gaps exceeding 1/4 inch with insulation.
    g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
    h. Loosely lay base layer of insulation units over substrate.
    i. Mechanically attach base layer of insulation (and substrate board at Gymnasium) using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
        1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
        2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
    a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
    b. Install with long joints continuous and with end joints staggered not less than 12 inchesin adjacent rows.
    c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
    f. Trim insulation so that water flow is unrestricted.
    g. Fill gaps exceeding 1/4 inch with insulation.
    h. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

i. Adhere each layer of insulation to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
   1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.
   a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
   a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 ADHERED ROOFING INSTALLATION

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll membrane roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.

G. Apply roof membrane with side laps shingled with slope of roof deck where possible.

H. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.

I. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

J. Adhere protection sheet over roof membrane at locations indicated.

3.8 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions and NRCA recommended details.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.

1. Install flexible walkways at the following locations:
    a. Perimeter of each rooftop unit.
    b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
    c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
    d. Top and bottom of each roof access ladder.
    e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
    f. Locations indicated on Drawings.
    g. As required by roof membrane manufacturer's warranty requirements.
2. Provide 6-inch clearance between adjoining pads.
3. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.11 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 5323

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SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed wall sheet metal fabrications.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 7100 "Roof Specialties" for roof specialties associated with low-slope roofs.
3. Section 07 7200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.2 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

C. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.8 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

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 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft.minimum.

2.4 MISCELLANEOUS MATERIALS

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

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.
2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.6 WALL SHEET METAL FABRICATIONS

A. Fascia and exposed wall counterflashings : Fabricate from the following materials:

1. Aluminum: 0.050 inch thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

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

C. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact

surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with [**elastomeric**] [**butyl**] sealant and clamp flashing to pipes that penetrate roof.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 07 6200

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SECTION 07 7100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copings.
2. Roof-edge specialties.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 6200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim, reglets and counterflashings.
3. Section 07 7200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
4. Section 07 9200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

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 specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.

C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

D. Samples for Verification:

1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section Section 07 5323 “Ethylene-Propylene-Diene-Monomer (EPDM) Roofing”.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.7 WARRANTY

A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section Section 07 5323 “Ethylene-Propylene-Diene-Monomer (EPDM) Roofing”

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. SPRI Wind Design Standard: Manufacture and install copings and roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings.

B. 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 sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Architectural Products Company.
   b. ATAS International, Inc.
   c. Cheney Flashing Company.
   d. Firestone Metal Products Una Clad.
   e. Merchant & Evans Inc.

f. Metal-Era, Inc.
g. OMG Roofing Products. (Hickman)
h. Perimeter Systems; a division of SAF.
i. Petersen Aluminum Corporation.

2. Formed Aluminum Sheet Coping Caps: Aluminum sheet, 0.050 inch thick.
   a. Surface: Smooth, flat finish.
   b. Finish: Clear anodic.

3. Corners: Factory mitered and continuously welded.
4. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.
   a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.

B. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding [**12 feet**] <**Insert dimension**>, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. Formed Aluminum Sheet Coping Caps: Aluminum sheet, 0.050 inch thick.
2. .
   a. Surface: Smooth, flat finish.
   b. Finish: Clear anodic.

2.3 ROOF-EDGE SPECIALTIES

A. Canted Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet cant, 0.028 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Architectural Products Company.
   b. ATAS International, Inc.
   c. Firestone Building Products
   d. Merchant & Evans Inc.
   e. Metal-Era, Inc.
   f. OMG Roofing Products.
   g. Petersen Aluminum Corporation.

2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.050 inch thick.
   a. Surface: Smooth, flat finish.
   b. Finish: Clear anodic.

3. Corners: Factory mitered and continuously welded.
4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Architectural Products Company.
   b. ATAS International, Inc.
   c. Exceptional Metals.
   d. Merchant & Evans Inc.

e. Metal-Era, Inc.
f. OMG Roofing Products.
g. Petersen Aluminum Corporation.

2.4 REGLETS AND COUNTERFLASHINGS

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

1. Cheney Flashing Company.
2. Fry Reglet Corporation.
3. Hickman Company, W. P.
4. Metal-Era, Inc.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

1. Zinc-Coated Steel: Nominal 0.028-inch thickness.
2. Corners: Factory mitered and continuously welded.
3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:

1. At Reglets: Zinc-coated steel, nominal 0.028-inch thickness.
2. At Through-Wall Flashing: Stainless steel, 0.025 inch thick.

D. Accessories:

1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

E. Stainless Steel Finish: ASTM A480/A480M No. 2B (bright, cold rolled, unpolished).

2.5 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.6 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970/D 1970M; stable after testing at 240 deg F.
2. Low-Temperature Flexibility: ASTM D 1970/D 1970M; passes after testing at minus 20 deg F.

B. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. minimum.

2.7 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.8 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
2. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. 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. Coil-Coated Aluminum Sheet Finishes:

1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

C. Aluminum Extrusion Finishes:

1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

1. Apply continuously under copings roof-edge specialties and reglets and counterflashings.
2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

B. Slip Sheet: Install over underlayment with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.2 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.3 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.

3.4 ROOF-EDGE SPECIALITIES INSTALLATION

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.5 REGLET AND COUNTERFLASHING INSTALLATION

A. Embedded Reglets: See Section 04 2000 "Unit Masonry" for installation of reglets.

B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed.

END OF SECTION 07 7100

SECTION 07 7200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. ction 07 6200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
2. Section 07 7100 "Roof Specialties" for manufactured fasciae, copings, gravel stops, gutters and downspouts, and counterflashing.
3. Section 07 7129 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint covers.
4. Section 23 3423 "HVAC Power Ventilators" for power roof-mounted ventilators.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

B. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF HATCHES

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Babcock-Davis.
   b. Bilco Company (The).

c. Nystrom, Inc.

B. Type and Size: Single-leaf lid, 36 by 36 inches.

C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

D. Hatch Material: Aluminum sheet.

1. Thickness: 0.090 inch.
2. Finish: Baked enamel or powder coat.
3. Color: As selected by Architect from manufacturer's full range.

E. Construction:

1. Insulation: Polyisocyanurate board.
   a. R-Value: 12.0 according to ASTM C 1363.
2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
4. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
5. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
6. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

F. Hardware: Spring operators, hold-open arm, galvanized-steel spring latch with turn handles, galvanized-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

1. Provide two-point latch on lids larger than 84 inches.
2. Provide remote-control operation.

G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

1. Height: 42 inches above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
8. Fabricate joints exposed to weather to be watertight.
9. Fasteners: Manufacturer's standard, finished to match railing system.
10. Finish: Manufacturer's standard.
    a. Color: As selected by Architect from manufacturer's full range.

H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches above finished roof deck.
3. Material: Steel tube.
4. Post: 1-5/8-inch- diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat.
   a. Color: As selected by Architect from manufacturer's full range.

2.3 METAL MATERIALS

A. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Steel Tube: ASTM A 500/A 500M, round tube.

C. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized according to ASTM A 123/A 123M.

D. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.

C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

D. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

F. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

3.2 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

B. Clean exposed surfaces according to manufacturer's written instructions.

C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 7200

SECTION 07 8413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Penetration firestopping systems for the following applications:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

B. Related Requirements:

1. Section 07 8443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product test reports.

1.4 CLOSEOUT SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to

install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

C. Do not cover up penetration firestopping installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
    a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
        1) UL in its "Fire Resistance Directory."
        2) Intertek Group in its "Directory of Listed Building Products."
        3) FM Approval in its "Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

D. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For 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. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

3.3 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 07 8413

SECTION 07 8443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

B. Related Requirements:

1. Section 07 8413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
2. Section 09 2216 "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.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

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 firestopping systems shall bear classification marking of a qualified testing agency.
        1) UL in its "Fire Resistance Directory."
        2) Intertek Group in its "Directory of Listed 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 shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.

1. 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 at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.

1. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. Low-Emitting Materials: Fire-resistive joint system sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

G. Accessories: 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. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to 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 "Fire Resistance Directory" under product Category XHBN.

B. Head-of-Wall, Fire-Resistive Joint Firestopping Systems : At the top of each fire-rated concrete or masonry wall, provide the following:

1. UL-Classified Systems: HW-S-0021, HW-S-0024, HW-S-0025, HS-S-0027, or HW-S-0029.
2. Nominal Joint Width: 1 inch.
3. Movement Capabilities: Class II - percent compression or extension.

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, or HW-D-0042.
2. Nominal Joint Width: 1 inch.
3. Movement Capabilities: Class II - percent compression or extension.

END OF SECTION 07 8443

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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

B. Related Requirements:

1. Section 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. 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 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.

2.5 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.

2.6 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.

2.7 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.

2.8 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.

3. Joint-Sealant Color: Provide custom colors to match each material that the sealant is adjacent to..

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 Color: Provide custom colors to match each material that the sealant is adjacent to.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces JS-3.

1. Joint Locations:
   a. Isolation joints in exposed cast-in-place concrete slabs.
   b. Control and expansion joints in tile flooring.
   c. Insolation and control joints in cast-in-place concrete slabs concealed by wood floors.
   d. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, P, 25, T, NT.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces JS-4.

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. Joints on underside of plant-precast structural concrete planks.
   e. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement JS-5.

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 windows and elevator entrances.
   c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-6.

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.

G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-7.

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.

H. Joint-Sealant Application: Concealed mastics JS-8.

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.

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.

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.

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.

END OF SECTION 07 9219

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. 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.

C. 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: At vertical exit enclosures and exit passageways, 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
g. and temperature-rise-rated doors.

2. Frames:
   a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
   b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
   c. Construction: Face welded.

3. Exposed Finish: Prime.

2.4 BORROWED LITES

A. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch.

B. Construction: Face welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.5 LOUVERS

A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch- thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.

B. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

2.6 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.

2.7 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."

2.8 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. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
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.

2.9 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.
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.
6. 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 1416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.
4. Wood sound control doors. (Music Room)

B. Related Requirements:

1. Section 08 8000 "Glazing" for glass view panels in flush wood doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Door frame construction.
7. Factory-machining criteria.
8. Factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory finished and application requirements.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.

B. Product Test Reports: For each sound control door assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1.

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4:

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Delamination of veneer.
   b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
   c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, 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. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

C. Sound Rating (Music Room): Provide sound control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:

1. STC Rating: 42 as calculated by ASTM E413 when tested in an operable condition in accordance with ASTM E90.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

2.3 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Eggers Industries.
   b. Masonite Architectural.
   c. Oshkosh Door Company.
   d. VT Industries Inc.

2. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.
3. Door Thickness: 1-3/4 inches unless indicated otherwise.
4. ANSI/WDMA I.S. 1A Grade: Premium.
5. Faces: Single-ply wood veneer not less than 1/50 inch thick.
   a. Species: Select white birch.
   b. Veneer Face Grade: A.
   c. Cut: Rotary cut.
   d. Match between Veneer Leaves: Book match.

e. Assembly of Veneer Leaves on Door Faces: Running match.
f. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

6. Exposed Vertical and Top Edges: Applied wood edges of same species as faces and covering edges of crossbands - Architectural Woodwork Standards edge Type D.
   a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
   b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
   c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
      1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.

7. Core for Non-Fire-Rated Doors:
   a. ANSI A208.1, Grade LD-2 particleboard.
      1) Blocking: Provide wood blocking in particleboard-core doors as follows:
         a) 5-inch top-rail blocking, in doors indicated to have closers.
         b) 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
      2) Provide doors with WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 7100 "Door Hardware."
   b. WDMA I.S. 10 structural composite lumber.
      1) Screw Withdrawal, Door Face: 550 lbf.
      2) Screw Withdrawal, Vertical Door Edge: 550 lbf.

8. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
   a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as follows:
      1) 5-inch top-rail blocking.
      2) 5-inch bottom-rail blocking, in doors indicated to have protection plates.
      3) 5-inch midrail blocking, in doors indicated to have armor plates.
      4) 5-inch midrail blocking, in doors indicated to have exit devices.

9. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.
10. Adhesives: Type I in accordance with WDMA T.M. 6.

2.4 WOOD SOUND CONTROL DOORS (Music Room)

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

1. VT Industries, Heritage STC, Basis of Design, Sound Attenuation Core
2. Masonite Architectural, Acoustic Solutions
3. AMBICO Limited.
4. Krieger Specialty Products Company.
5. Overly Door Company.

B. STC: 42 minimum for door slab and door light frame.

C. Perimeter Gasketing and Drop Seals: To achieve STC ratings, see Hardware specification section.

D. Face Veneers and Vertical Stile Edges: Match other wood doors to the greatest extent possible.

2.5 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

C. Metal Louvers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Activar Construction Products Group, Inc.
   b. Allegion plc.
   c. Anemostat Products; a Mestek company.
   d. ASSA ABLOY.
   e. L & L Louvers, Inc.
   f. McGill Architectural Products.

2. Blade Type: Vision-proof, inverted V.
3. Metal and Finish: Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 8000 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. WDMA I.S. 1A Grade: Premium.
2. Finish: WDMA I.S. 1A TR-6 Catalyzed Polyurethane.
3. Staining: Match Architect's sample.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Section 08 7100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.2 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 1416

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SECTION 08 3113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

B. Related Requirements:

1. Section 07 7200 "Roof Accessories" for roof hatches.
2. Section 23 3300 "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of access door and frame and for each finish specified.

C. Product Schedule: For access doors and frames.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

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

1. Acudor Products, Inc.
2. JL Industries, Inc.; a division of the Activar Construction Products Group.
3. Karp Associates, Inc.
4. Milcor; Commercial Products Group of Hart & Cooley, Inc.
5. Nystrom, Inc.
6. Williams Bros. Corporation of America (The).

B. Flush Access Doors with Exposed Flanges:

1. Description: Face of door flush with frame, with exposed flange and concealed hinge.
2. Optional Features: Piano hinges.
3. Locations: Walls of masonry construction.
4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.

5. Frame Material: Same material, thickness, and finish as door.
6. Latch and Lock: Cam latch, spanner-head wrench operated.

C. Flush Access Doors with Concealed Flanges:

1. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
2. Locations: Wall and ceiling.
3. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
4. Frame Material: Same material and thickness as door.
5. Latch and Lock: Cam latch, spanner-head wrench operated.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

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

1. Acudor Products, Inc.
2. JL Industries, Inc.; a division of the Activar Construction Products Group.
3. Karp Associates, Inc.
4. Milcor; Commercial Products Group of Hart & Cooley, Inc.
5. Nystrom, Inc.
6. Williams Bros. Corporation of America (The).

B. Fire-Rated, Flush Access Doors with Exposed Flanges:

1. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
2. Optional Features: Gasketing.
3. Locations: Wall.
4. Fire-Resistance Rating: Not less than adjacent construction.
5. Temperature-Rise Rating: If access door is in a stairway enclosure wall 450 deg F at the end of 30 minutes.
6. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage, factory [**primed**] [**finished**].
7. Frame Material: Same material, thickness, and finish as door.
8. Latch and Lock: Self-latching door hardware, operated by key.

2.4 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Frame Anchors: Same material as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.5 FABRICATION

A. 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.

B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

C. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.2 ADJUSTING

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

END OF SECTION 08 3113

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SECTION 08 3323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-rated 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. Curtain slats.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing and inspecting agency.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.
2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate, or statement of equal knowledge and experience acceptable to authorities with jurisdiction.

B. 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.

B. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

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. McKeon Rolling Steel Door Company, Inc.
4. Overhead Door Corporation. Basis of Design Model 630
5. Raynor.
6. 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. Fire-Rated Door Assemblies: Complying with NFPA 80; listed and labeled by qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.

1. Smoke Control:, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of 3.0 cfm/sq. ft. of door opening at 0.10 inch wg for both ambient and elevated temperature tests.

B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.3 FIRE-RATED DOOR ASSEMBLY

A. Fire-Rated Service Door (Library 114 to Heart 110 atrium fire separation, Café to Serving): Overhead fire-rated 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. Fire Rating: 3/4 hour with smoke control.
3. Door Curtain Material: Galvanized steel.
4. Door Curtain Slats: Flat profile slats of 1-7/8-inch to 2-5/8-inch center-to-center height.
    a. For Café to Serving provide Insulated-Slat Interior Flat Profile Facing: Metal.
5. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
6. Hood: Match curtain material and finish.
    a. Mounting: Face of wall.
7. Locking Devices: Equip door with locking device assembly.
    a. Locking Device Assembly: Cremone-type, both jamb sides locking bars, operable from outside with cylinder inside and outside with cylinders.
8. 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 characteristics.
    e. Emergency Manual Operation: Crank type.
    f. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.
    g. Control Station(s): Where indicated on Drawings.
9. Curtain Accessories: Equip door with smoke seals, automatic-closing device,.
10. Door Finish:
    a. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range of 200 RAL Colors for Café to Serving door. One of 4 standard colors for Library to Heart concealed above ceiling door.
    b. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

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. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
2. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 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.

2.7 LOCKING DEVICES

A. 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".

B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 CURTAIN ACCESSORIES

A. Smoke Seals: Equip each fire-rated door with replaceable smoke-seal perimeter gaskets or brushes for smoke and draft control as required for door listing and labeling by a qualified testing agency.

B. Pull Hooks: Provide pole hooks and poles for doors more than 84 inches high.

C. Automatic-Closing Device: Equip each fire-rated door with an automatic-closing device or holder-release mechanism and governor unit complying with NFPA 80 and an easily tested with automatic reset release mechanism. Testing for manually operated doors shall allow resetting by opening the door without retensioning the counterbalance mechanism Release mechanism for motor-operated doors shall allow testing without mechanical release of the door.

1. Automatic-closing device shall be designed for activation by the following:
   a. Manufacturer's standard UL-labeled smoke detector and door-holder-release devices.

b. Manufacturer's standard UL-labeled heat detector and door-holder-release devices.
c. Building fire-detection, smoke-detection, and -alarm systems.

2. 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 fire-rated doors, activation delays closing.

1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
    a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.

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.

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. Steel and Galvanized-Steel Finishes:

1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
    a. Where powder-coat finish is indicated as selected from manufacturer’s full range, provide minimum of 50 color selections.

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. Fire-Rated Doors: Install according to NFPA 80.

C. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

D. Power-Operated Doors: Install according to UL 325.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.
2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.3 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. Lubricate bearings and sliding parts as recommended by manufacturer.
2. Adjust seals to provide tight fit around entire perimeter.

3.4 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 4113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

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. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

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

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

E. 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: NFRC-certified energy performance values from manufacturer.

C. Sample warranties.

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.

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.

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 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, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

1. Obtain aluminum doors and frames through a single source. Verify that doors and frames will operate and seal properly with specified hardware.

2.2 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 clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
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. (based on center of glass Winter Nighttime U-Factor: 0.25 maximum.)

2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas as a system shall have SHGC of no greater than 0.35 as determined according to NFRC 200.
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 62 as determined according to 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.

2.3 STOREFRONT SYSTEMS

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

1. EFCO Corporation.
2. Kawneer North America, TriFab VersaGlaze 601-UT basis of design
3. Oldcastle BuildingEnvelope.
4. Special-Lite, Incorporated.
5. Tubelite.
6. Wausau Metals.
7. YKK AP America Inc.

B. 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 North Armerica; Trifab 601 UT.
2. Frame Profile: 2 inches wide by 6 to 6-1/2 inches deep.
3. Exterior Framing Construction: Thermally broken.
4. Interior Vestibule Framing Construction: Nonthermal.
5. Glazing System: Retained mechanically with gaskets on four sides. Where shown provide glazing system retained mechanically on top and bottom and structurally glazed butt joints on corners.
6. Glazing Plane: Front of center.
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.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Insulated Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.

1. Basis of Design: Mapes Architectural Panels, Mapes-R+ Rabbet Edge Panel, 8 ply

2. Basis of Design: Exterior Skin High Pressure Compact Laminate, Central Elementary School Trespa
   a. Trespa Meteon Unicolours, Color Ochre, Finish Satin
   b. Trespa Meteon Unicolours, Color Rusty Red, Finish Satin
   c. Trespa Meteon Unicolours, Silver Grey, Finish Satin
   d.

3. Overall Panel Thickness: 2 inches (includes 1 inch rabbet to insert in storefront glazing channel.
4. Finish
   a. Exterior: Custom Kynar
   b. Interior: Custom Kynar
   c. Color as selected by architect.

5. Panel Fabrication
   a. Exterior Substrate: Cement Board 0.157 inch
   b. Exterior Core: Isocyanurate
   c. Smooth Mill Aluminum
   d. Secondary Exterior Substrate: Cement Board
   e. Interior Core: Isocyanurate
   f. Interior Substrate: Cement Board 0.157 inch
   g. Tolerances - .8% of panels dimension length and width - (+/-) 1/16" thickness

6. Overall Panel Thickness - 2"
7. Glazing Leg Thickness - 1"
8. R-Value - 13
9. U-Value - 0.08

2.4 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.
4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
   a. Provide nonremovable glazing stops on outside of door.

B. Fiberglass Reinforced Polyester Doors (FRP): Fiberglass reinforced polyester skins rabbeted into extruded aluminum frames with a poured-in-place insulation core as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Aluminum and Glass.
   b. Commercial Door Systems.
   c. Special-Lite, Incorporated.
   d. 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. FRP Facing Sheets: 0.120-inch thick fiberglass reinforced polyester. Provide dark bronze color and a lighter color as selected from manufacturer's full range.
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.

2.5 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.

2.6 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.

2.7 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.

2.8 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.

2.9 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. 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.

F. 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.

G. 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.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker. Refer to drawings for locations.

B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

C. Color: Dark bronze. Refer to drawings for locations.

1.

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. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 9200 "Joint Sealants," to produce weathertight installation.

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. Install glazing as specified in Section 08 8000 "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.

H. 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.

3.2 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.

END OF SECTION 08 4113

SECTION 08 4329 - SLIDING STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Aluminum sliding mall fronts for interior applications.

B. Related Sections include the following:

1. Section 05 5000 "Metal Fabrications."
2. Section 06 1000 "Rough Carpentry."
3. Section 07 9200 "Joint Sealants" for perimeter sealants and backup materials.
4. Section 08 4113 "Aluminum-Framed Entrances and Storefronts."
5. Section 08 7100 "Door Hardware" for door hardware not specified in this Section.
6. Section 08 8000 "Glazing."

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings:

1. Submit shop drawings indicating design, fabrication and installation of systems.
2. Include dimensional plans and elevations.
3. Include large-scale details of typical members, glazing components and accessories.
4. Include attachments to adjacent materials.
5. Include hardware details and locations.

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

D. Samples for Verification: Of each type of exposed finish required, prepared on Samples 12 inches long and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer with a record of successful installations, who is an authorized representative of the sliding storefront manufacturer for both installation and maintenance of units required for this Project.

B. Perform Work in accordance with AAMA SFM1 and manufacturer's written instructions.

C. Conform to requirements of ANSI A117.1 and local amendments.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings to receive sliding storefronts by field measurements before fabrication.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of sliding storefronts that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer agrees to repair finishes or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain sliding storefronts from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Opening Force: Not more than 5 lbf to fully open door.

B. Air Leakage: Entrance assemblies for pressurized rooms shall be listed and labeled for smoke and draft control by qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and having maximum air leakage according to NFPA 105 unless otherwise indicated.

2.3 SLIDING STOREFRONT ASSEMBLIES

A. General: Provide manufacturer's standard factory-glazed sliding storefronts including door leaves, sidelites, framing, headers, carrier assemblies, roller tracks, and accessories required for a complete installation as indicated.

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
   a. Kawneer 1010 Sliding Mall Front, Basis of Design
   b. Alumicor Ltd., WisperGlide
   c. Arcadia, 2820 Series
   d. Oldcastle Building Envelope. MS-360 (modified for thicker acoustic glass?)
   e. U. S. Aluminum, CR Laurence, 2000 Series

C. Sliding Storefront (between Learning Studios and Learning Studios and Corridors):

1. Configuration: Biparting-telescoping four-panel door, with two operable leaves on each side; All four panels slide into pockets. Provide pocket closures.
2. Mounting: Surface. Mount to inside surface of pocket.
3. Track: Manufacturer's standard design and finish in threshold with maximum 1/2-inch height, complete with appropriate support assemblies. Track recessed into floor to create flush to finished flooring material top surface.
4. Stile Design: 1 3/4 inch Rail Design: 1 3/8 inch top rail, 3 1/4 inch bottom rail Glazing Stops and Gaskets: Square.
5. Hardware: Manufacturer standard pull with lock and cylinder specified in Section 08 7100.
6. Glazing: Insulated Laminated Glazing Unit see Section 08 8000 Glazing.
7. Finish: Finish framing, door(s), sidelite(s), and header with baked-enamel or powder-coat finish.
   a. Color: .See Interiors Drawings, Material Selection Schedule.

2.4 COMPONENTS

A. Framing Members: Extruded aluminum, minimum 0.125 inch thick and reinforced as required to support imposed loads. Provide head track frame. Provide jamb frames with sound resistant seals. Provide pocket full closure plate that travels with the pocket door, with a weatherstripped receiver on the opposite side of the pocket. Closure plate to close pocket when doors are in the closed position.

1. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch wall thickness.

B. Stile and Rail Doors: 1-3/8-inch- thick glazed doors with minimum 0.125-inch- thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie rods that span full length of top and bottom rails.

1. Glazing Stops and Gaskets: Snap-on, extruded-aluminum stops and preformed gaskets for glazing indicated.
2. Muntin Bars: Horizontal tubular rail member for each door; match stile design.

C. Sidelites: 1-3/8-inch- deep sidelites with minimum 0.125-inch- thick, extruded-aluminum tubular stile and rail members matching door design and finish.

1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
2. Muntin Bars: Horizontal tubular rail member for each sidelite; match stile design.

D. Glazing: As specified in Section 08 8000 "Glazing."

E. Carrier Assemblies and Roller Tracks: Assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track or of ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track.

F. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 HARDWARE

A. General: Provide units in sizes and types recommended by sliding storefront and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish unless otherwise indicated.

B. Pulls: Recessed units on both sides of each operable door.

C. Deadlocks: Operated by exterior cylinder and interior thumb turn.

1. Deadbolts: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.
2. Cylinders: As specified in Section 08 7100 "Door Hardware.".

2.6 FABRICATION

A. General: Factory fabricate sliding storefront components to designs, sizes, and thicknesses indicated and to comply with indicated standards.

B. Framing: Provide sliding storefronts as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."

E. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.

1. Provide sliding weather stripping, mortised into door, at perimeter of sliding surfaces and breakaway sidelites.

2.7 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
2. Sheet and Plate: ASTM B 209.

B. Sealants and Joint Fillers: As specified in Section 07 9200 "Joint Sealants."

C. Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout complying with ASTM C 1107/C 1107M; of consistency suitable for application.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.8 FINISH REQUIREMENTS

A. General: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
2. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. 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. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install sliding storefronts according to manufacturer's written instructions.

1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
2. Where aluminum contacts dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
3. Where aluminum contacts concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.

B. Install sliding storefronts plumb, true in alignment with established lines and grades, and without warp or rack of framing members and doors. Anchor securely in place.

1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.

3. Level recesses for recessed floor tracks using shrinkage-resistant grout.

C. Sealants: Comply with requirements in Section 07 9200 "Joint Sealants" for installing sealants, fillers, and gaskets.

1. Set framing members, floor tracks, and flashings in full sealant bed.
2. Seal perimeter of framing members with sealant.

D. Adjust force to open door panels.

E. Adjust entrance doors for tight closure.

END OF SECTION 08 4329

SECTION 08 4523 - FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes aluminum-framed assemblies incorporating fiberglass-sandwich panels as follows:

1. Wall assemblies. Installed in perimeter storefront aluminum frame.

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 panel assemblies. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: In manufacturer's standard size.

1. For each type of fiberglass-sandwich panel.
2. For each type of exposed finish for framing members.

D. Delegated-Design Submittal: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product test reports.

C. Evaluation Research Reports: For fiberglass-sandwich-panel assemblies from ICC-ES.

D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

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

1.7 QUALITY ASSURANCE

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

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies 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. Deterioration of metals and other materials beyond normal weathering.
   c. Water leakage.

2. Warranty Period: Two years from date of Substantial Completion.

B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace fiberglass-sandwich panels that exhibit defects in materials or workmanship within specified warranty period.

1. Defects include, but are not limited to, the following:
   a. Fiberbloom.
   b. Delamination of coating, if any, from exterior face sheet.
   c. Color change exceeding requirements.
   d. Delamination of panel face sheets from panel cores.

2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
2. Warranty Period: 20 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 fiberglass-sandwich-panel assemblies.

B. Structural Loads: As indicated on Drawings.

C. Deflection Limits:

1. Vertical Panel Assemblies: Limited to 1/120 of clear span for each assembly component.

D. Structural-Test Performance: ASTM E 330.

1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and 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.

E. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft..

F. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

G. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC:

1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than values indicated for panel types as determined according to NFRC 100.
2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas shall have a SHGC of no greater than values indicated for panel types as determined according to NFRC 200.
3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft..

2.2 FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

A. Fiberglass-Sandwich-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with fiberglass-sandwich panels.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Kalwall Corporation.
   b. Major Industries, Inc.

2.3 FIBERGLASS-SANDWICH PANELS

A. Fiberglass-Sandwich Panels: Uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core.

1. Core Insulation: Fill panel cores with aerogel.
2. Panel Thickness: 2-3/4 inches .

3. Grid Core: Mechanically interlocked, extruded-aluminum I-beams, with a minimum flange width of 7/16 inch.
   a. Extruded Aluminum: ASTM B 221, in alloy and temper recommended in writing by manufacturer.
   b. I-Beam Construction: Thermally broken, extruded aluminum.
   c. I-Beam Construction: [One piece, extruded aluminum] [Thermally broken, extruded aluminum].
   d. Grid Pattern: Staggered rectangle, nominal 12 by 24 inches and Square, nominal 12 inches As indicated on Drawings.

4. Exterior Face Sheet:
   a. Thickness: Not less than 0.052 inch.
   b. Color: As selected by Architect from manufacturer's full range.
   c. Protective Weathering Surface: Manufacturer's standard.
   d. Impact Resistance: No fracture or tear at impact of 230 ft. x lbf by a 3-1/4-inch- diameter, 5-lb freefalling ball according to UL 972 test procedure.

5. Interior Face Sheet:
   a. Thickness: Not less than 0.052 inch.
   b. Color: As selected by Architect from manufacturer's full range.
   c. Impact Resistance: No fracture or tear at impact of by a 3-1/4-inch- diameter, 5-lb freefalling ball according to UL 972 test procedure.

6. Thermal Transmittance (U-Factor): 0.24 Btu/sq. ft. x h x deg F maximum.
7. Solar Heat Gain Coefficient (SHGC): 0.6 0.7 0.36maximum.
8. Visible Light Transmission: Minimum 30 percent.

B. Panel Strength:

1. Maximum Panel Deflection: 3-1/2 inches when a 4-by-12-foot panel is tested according to ASTM E 72 at 34 lbf/sq. ft., with a maximum 0.090-inch set deflection after five minutes.
2. Panel Support Strength: Capable of supporting, without failure, a 300-lbf concentrated load when applied to a 3-inch- diameter disk according to ASTM E 661.

C. Panel Performance:

1. Self-Ignition Temperature: 650 deg F or more according to ASTM D 1929.
2. Smoke-Developed Index: 450 or less according to ASTM E 84, or 75 or less according to ASTM D 2843.
3. Combustibility Classification for Panels in Walls: Class CC1 based on testing according to ASTM D 635.
4. Interior Finish Classification: Class B based on testing according to ASTM E 84.
5. Color Change: Not more than 3.0 units Delta E, when measured according to ASTM D 2244, after outdoor weathering compliant with procedures in ASTM D 1435.
   a. Outdoor Weathering Conditions: Sixty months in southern Florida.

2.4 ALUMINUM FRAMING SYSTEMS

A. Components: Thermally broken, extruded aluminum.

B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.

D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.

E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

F. Anchor Bolts: ASTM A 307, Grade A, galvanized steel.

G. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Exposed Flashing and Closures: Aluminum sheet not less than 0.050 inch thick, finished to match framing.

I. Framing Gaskets: Manufacturer's standard.

J. Frame-System Sealants: As specified in Section 07 9200 "Joint Sealants."

K. Corrosion-Resistant Coating: Cold-applied asphalt mastic.

2.5 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written instructions.

1. Do not install damaged components.
2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
3. Rigidly secure nonmovement joints.
4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
5. Seal joints watertight unless otherwise indicated.

B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

C. Install components plumb and true in alignment with established lines and elevations. Install in perimeter storefront aluminum frame as shown on drawings.

D. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:

1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet, but no greater than 1/2 inch over total length.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies shall be tested according to AAMA 501.2 and shall not show evidence of water penetration.

B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 08 4523

SECTION 08 7100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:
   a. Swinging doors.
   b. Sliding doors.
   c. Folding doors.
2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

B. Related Requirements:

1. Section 08 1113 "Hollow Metal Doors and Frames" [**for astragals provided as part of labeled fire-rated assemblies**] [**and**] [**for door silencers provided as part of hollow-metal frames**].
2. Section 08 1416 "Flush Wood Doors" for [**astragals**] [**and**] [**integral intumescent seals**] provided as part of labeled fire-rated assemblies.
3. Section 08 3113 "Access Doors and Frames" for access door hardware, [**except**] [**including**] cylinders.
4. Section 08 4113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, [**except**] [**including**] cylinders.
5. Section 10 2213 "Wire Mesh Partitions" for door hardware for doors in wire mesh partitions, [**except**] [**including**] cylinders.
6. Section 10 2600 "Wall and Door Protection" for plastic door protection units that match wall protection units.
7. Section 28 1300 "Access Control" for access control devices installed at door openings and provided as part of a security system.
8. Section 28 3100 "Fire Detection and Alarm" for connections to building fire-alarm system.

1.2 PREINSTALLATION MEETINGS

A. Keying Conference: Conduct conference at [**Project site**] <**Insert location**>.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.

C. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule [**after**] [**or**] [**concurrent with**] submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format[**and use same door numbers**] as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:
    a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
    d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
    e. Fastenings and other installation information.
    f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
    g. Mounting locations for door hardware.
    h. List of related door devices specified in other Sections for each door and frame.

D. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [Installer] [and] [Architectural Hardware Consultant].

B. Product Certificates: For each type of electrified door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final [**door hardware**] [**and**] [**keying**] schedule.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an [**Architectural Hardware Consultant (AHC)**] [**Architectural Hardware Consultant (AHC) and an Electrified Hardware Consultant (EHC)**] [**Architectural Openings Consultant (AOC)**].

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

D. Deliver keys[**and permanent cores**] to Owner by registered mail or overnight package service.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: [**Three**] <**Insert number**> years from date of Substantial Completion unless otherwise indicated below:
   a. [**Electromagnetic**] [**and**] [**Delayed-Egress**] Locks: [**Five**] <**Insert number**> years from date of Substantial Completion.
   b. Exit Devices: [**Two**] <**Insert number**> years from date of Substantial Completion.
   c. Manual Closers: [**10**] <**Insert number**> years from date of Substantial Completion.
   d. Concealed Floor Closers: [**Five**] [**10**] [**25**] <**Insert number**> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:
   a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
   b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
   c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.

1. Door hardware is scheduled in Part 3.

2.4 HINGES

A. Barrel Hinges: BHMA A156.1.[Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.]

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Self-Closing Hinges and Pivots: BHMA A156.17.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

C. Center-Hung and Offset Pivots: BHMA A156.4.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

D. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

1. Pin-and-Barrel-Type Hinges:
   a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
   a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.5 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
3. Deadbolts: Minimum [**1-inch**] [**1.25-inch**] <**Insert dimension**> bolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Description: [**As indicated on Drawings**] <**Insert description or manufacturer's design designation**>.
2. Levers: [**Wrought**] [**Forged**] [**Cast**].
   a. <**Insert model number and description**>.

3. Escutcheons (Roses): [**Wrought**] [**Forged**] [**Cast**].
4. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

F. Bored Locks: BHMA A156.2; [**Grade 1**] [**Grade 2**]; Series 4000.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

G. Mortise Locks: BHMA A156.13; [**Operational Grade 1**] [**Security Grade 1**] [**Operational Grade 2**] [**Security Grade 2**]; stamped steel case with steel or brass parts; Series 1000.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.6 AUXILIARY LOCKS

A. Bored Auxiliary Locks: BHMA A156.36: [**Grade 1**] [**Grade 2**]; with strike that suits frame.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Backset: [**2-3/8 inches**] [**2-3/4 inches**].

B. Mortise Auxiliary Locks: BHMA A156.36; [**Grade 1**] [**Grade 2**]; with strike that suits frame.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Backset: [**2-3/4 inches**] <**Insert dimension**>.

C. Narrow Stile Auxiliary Locks: BHMA A156.36; [**Grade 1**] [**Grade 2**]; with strike that suits frame.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Backset: [**0.98 inch**] [**1.125 inches**] [**1.25 inches**] [**1.5 inches**] [**1.75 inches**] [**2 inches**] [**2.25 inches**] [**2.5 inches**] <**Insert dimension**>.
3. Strike: [**Flat**] [**Flat with extra-long lip**] [**Radius**] [**Radius with weatherstrip**] [**Bevel**].

D. Push-Button Combination Locks: BHMA A156.36; cylindrical; Grade 1; lock opens by entering a one- to five-digit code by pushing correct buttons in correct sequence; automatically relocks when door is closed; with strike that suits frame.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.7 ELECTRIC STRIKES

A. Electric Strikes: BHMA A156.31; [**Grade 1**] [**Grade 2**]; with faceplate to suit lock and frame.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Fire-Rated Door Assemblies: Use fail-secure electric strikes with fire-rated devices.

2.8 ELECTROMAGNETIC LOCKS

A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Direct-Hold Type: Lock mounted on [bottom of header; strike flush mounted on door push side] [face of header; strike angle mounted on door pull side] [side of jamb; strike flush mounted on door push side].
3. Shear Type: Lock [**mounted on face of header; strike angle mounted on door**] [**mortised in header; strike mortised in top of door**] [**mortised in jamb; strike mortised in edge of door**] [**mortised in bottom of door; strike mortised in floor**] [**mortised in floor; strike mortised in bottom of door**].
4. Strength Ranking: [**1500 lbf**] [**1000 lbf**] [**500 lbf**].
5. Inductive Kickback Peak Voltage: Not more than [**53**] [**0**] V.
6. Residual Magnetism: Not more than [**4 lbf**] [**0 lbf**] to separate door from magnet.
7. Features:
    a. Magnetic bond sensor.
    b. Continuous housing for full width of door.
    c. Continuous housing for full height of door.
    d. Single LED indicators.
    e. Double LED indicators.
    f. Adjustable time delay with automatic relock.
    g. Integral door position switch.
    h. <**Insert feature**>.

B. Delayed-Egress Electromagnetic Locks: BHMA A156.24, electrically powered, with electromagnet attached to frame and armature plate attached to door; depressing push bar for more than three seconds initiates irreversible alarm and adjustable time delay for egress. When integrated with fire alarm, fire alarm voids time delay.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.9 ELECTROMECHANICAL LOCKS

A. Electromechanical Locks: BHMA A156.25; [**Grade 1**] [**Grade 2**]; motor or solenoid driven; with strike that suits frame.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Type: [**Bored**] [**Mortise latchbolt**] [**Mortise deadbolt**] [**Mortise deadlocking latchbolt**].

2.10 SELF-CONTAINED ELECTRONIC LOCKS

A. Self-Contained Electronic Locks: BHMA A156.25, [**bored**] [**mortise**]; with internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc-dichromate-plated, wrought-steel case, and strike that suits frame. Provide key override, low-battery detection and warning, LED status indicators, and ability to program at the lock.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.11 EXIT LOCKS AND EXIT ALARMS

A. Exit Locks and Alarms: BHMA A156.29, Grade 1.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.12 SURFACE BOLTS

A. Surface Bolts: BHMA A156.16.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.13 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Strike: [**Matching**] [**Dustproof**].

2.14 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.[**Include wear plates.**]

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Strikes: [**Matching**] [**Dustproof**].
3. Fire Rated: Listed and labeled for use in fire-rated assemblies.

2.15 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.16 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.[**Provide cylinder from same manufacturer of locking devices.**]

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Standard Lock Cylinders: BHMA A156.5; [**Grade 1**] [**Grade 1A**] [**Grade 2**] permanent cores; face finished to match lockset.

1. Core Type: [**Interchangeable**] [**Removable**].
2. Number of Pins: [**Five**] [**Six**] [**Seven**].
3. Lock Type: [**Mortise**] [**Rim**] [**Bored-lock**] type.

C. High-Security Lock Cylinders: BHMA A156.30; [**Grade 1**] [**Grade 2**] [**Grade 3**] permanent cores that are removable; face finished to match lockset.

1. Type: [**M, mechanical**] [**E, electrical**].
2. Number of Pins: [**Six**] [**Seven**].
3. Lock Type: [**Mortise**] [**Rim**] [**Bored-lock**] type.

D. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

E. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.17 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock.[**Incorporate decisions made in keying conference.**]

1. No Master Key System: Only change keys operate cylinders.
   a. Provide three cylinder change keys.

2. Master Key System: Change keys and a master key operate cylinders.
   a. Provide three cylinder change keys and five master keys.

3. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
   a. Provide three cylinder change keys and five each of master and grand master keys.

4. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.
   a. Provide three cylinder change keys and five each of master, grand master, and great-grand master keys.

5. Existing System:
   a. Master key or grand master key locks to Owner's existing system.
   b. Re-key Owner's existing master key system into new keying system.

6. Keyed Alike: Key all cylinders to same change key.

B. Keys: [Nickel silver] [Brass].

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
   a. Notation: [**"DO NOT DUPLICATE."**] [**Information to be furnished by Owner.**]

2.18 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.28; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of [**150**] <**Insert number**> percent of the number of locks.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Multiple-Drawer Cabinet: [**Grade 1**] [**Grade 2**] cabinet with drawers equipped with key-holding panels and key envelope storage, and progressive-type ball-bearing suspension slides. Include single cylinder lock to lock all drawers.
3. Wall-Mounted Cabinet: [**Grade 1**] [**Grade 2**] cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

4. Portable Cabinet: [**Grade 1**] [**Grade 2**] tray for mounting in file cabinet, equipped with key-holding panels, envelopes, and cross-index system.

B. Key Lock Boxes: Designed for storage of [**two**] [**10**] <**Insert number**> keys.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Features:
   a. Tamper switches to connect to intrusion detection system.
   b. <**Insert feature**>.

C. Key Control System Software: Multiple-index system for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.19 OPERATING TRIM

A. Operating Trim: BHMA A156.6; [**aluminum**] [**brass**] [**bronze**] [**stainless steel**] unless otherwise indicated.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.20 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release[**; and with internal override**].

B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

C. Astragals: BHMA A156.22.

2.21 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Cast-Aluminum Surface Closers: [**Grade 1**] [**Grade 2**]; Traditional type with mechanism enclosed in cast-aluminum alloy shell.

1. Mounting: [**Hinge side**] [**Opposite hinge side**] [**Parallel arm**] [**Bracket**].
2. Type: [**Regular arm**] [**Fusible-link holder arm**] [**Two-point hold-open arm**] [**Delayed action closing**] <**Insert type**>.

3. Backcheck: [**Factory preset**] [**Adjustable**], effective between 60 and 85 degrees of door opening.

C. Surface Closer without Cover: [**Grade 1**] [**Grade 2**]; Modern type.

1. Mounting: [**Hinge side**] [**Opposite hinge side**] [**Parallel arm**] [**Bracket**] [**Hinge side top jamb**] [**Opposite side top jamb**].
2. Type: [**Regular arm**] [**Hold open**] [**Fusible-link holder arm**] [**Slide track arm**] [**Dead stop**] [**Dead stop hold open**] [**Delayed action closing**] <**Insert type**>.
3. Backcheck: [**Factory preset**] [**Adjustable**], effective between 60 and 85 degrees of door opening.
4. Closing Power Adjustment: At least [**50**] [**35**] [**15**] percent more than minimum tested value.

D. Surface Closer with Cover: [**Grade 1**] [**Grade 2**]; Modern type with mechanism enclosed in cover.

1. Mounting: [**Hinge side**] [**Opposite hinge side**] [**Parallel arm**] [**Bracket**] [**Hinge side, top jamb**] [**Opposite side, top jamb**].
2. Type: [**Regular arm**] [**Hold open**] [**Fusible-link holder arm**] [**Slide track arm**] [**Dead stop**] [**Dead stop hold open**] [**Delayed action closing**] <**Insert type**>.
3. Backcheck: [**Factory preset**] [**Adjustable**], effective between 60 and 85 degrees of door opening.
4. Cover Material: [**Aluminum**] [**Plated steel**] [**Molded plastic**].
5. Closing Power Adjustment: At least [**50**] [**35**] [**15**] percent more than minimum tested value.

2.22 CONCEALED CLOSERS

A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Concealed-in-Door Closer: [**Grade 1**] [**Grade 2**]; mortised into top rail of minimum 1-3/4-inch- thick doors and track mortised into head frame; with double lever arm indicated.

1. Type: [**Surface shoe**] [**Mortised soffit plate**].
2. Arm: [**Regular**] [**Hold open**].
3. Closing Power Adjustment: At least [**50**] [**35**] [**15**] percent more than minimum tested value.

C. Concealed Overhead Closer: [**Grade 1**] [**Grade 2**]; mortised into head frame; with cast-metal body and exposed cover plate.

1. Type: [**Exposed arm with surface shoe, single acting**] [**Concealed arm and track, butt or pivot hung, single acting**] [**Concealed arm and track, center pivoted, single acting**] [**Concealed arm and track, center pivoted, double acting**].
2. Arm: [**Regular**] [**Automatic hold open**] [**Manually selected hold open**] [**Fusible-link holder arm**].
3. Track: [**Regular**] [**Automatic hold open**] [**Manually selected hold open**].
4. Cover Plate Material: [**Aluminum**] [**Plated steel**].
5. Backcheck: [**Factory preset**] [**Adjustable**].
6. Closing Power Adjustment: At least [**50**] [**35**] percent more than minimum tested value.

D. Concealed Floor Closer: [**Grade 1**] [**Grade 2**]; with cement case and cast-iron closer body case and top pivot.

1. Closer Type: [**Center pivoted; include top pivot**] [**Offset pivoted; include top pivot**] [**Independently hung**].
2. Door-Swing Type: [**Single**] [**Double**] acting.
3. Fire Rated: Listed for use in labeled fire-rated assemblies where indicated.
4. Function: [**Regular**] [**Automatic hold open**] [**Manually selected hold open**] [**Delayed action closing**].
5. Backcheck: [**Factory preset**] [**Adjustable**].
6. Closing Power Adjustment: At least [**50**] [**35**] percent more than minimum tested value.
7. Case Depth: [**Regular, 4 inches**] [**Shallow, 2 inches**].
8. Floor Plates: Provide [**flush cover plates matching door hardware finish**] [**recessed floor plates with insert of floor finish material and extended closer spindle to accommodate thickness of floor finish**] unless thresholds are indicated.
   a. Material: [**Aluminum**] [**Plated steel**].

2.23 CLOSER HOLDER RELEASE DEVICES

A. Closer Holder Release Devices: BHMA A156.15; Grade 1; closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door shall become self-closing on interruption of signal to release device. Automatic release is activated by [**smoke detection system**] [**loss of power**].

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Type: [**Single-point hold open**] [**Multiple-point hold open**] [**Free-swinging release**].
3. Mounting: [**Surface mounted on face of door**] [**Surface mounted on face of top jamb**] [**Surface mounted on stop**] [**Mortised into top rail of door**] [**Mortised into top jamb**] [**Recessed into floor**].
4. Features:
   a. Adjustable backcheck.
   b. Integral smoke detector.
   c. Adjustable spring power.
   d. Adjustable hold-open manual release force.
   e. <**Insert feature**>.

2.24 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.25 ELECTROMAGNETIC STOPS AND HOLDERS

A. Electromagnetic Door Holders: BHMA A156.15, Grade 1; [**wall-mounted electromagnetic single**] [**floor-mounted electromagnet single**] [**floor-mounted electromagnet double**] unit with strike plate attached to swinging door; coordinated with fire detectors and interface with fire-alarm system for labeled fire-rated door assemblies.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.26 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.27 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Maximum Air Leakage: When tested according to ASTM E 283 with tested pressure differential of 0.3-inch wg, as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.
2. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
3. Gasketing on Double Doors: 0.50 cfm per foot of door opening.

2.28 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.29 SLIDING DOOR HARDWARE

A. Sliding Door Hardware: BHMA A156.14; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories indicated.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.30 FOLDING DOOR HARDWARE

A. General: BHMA A156.14; complete sets including overhead rails, hangers, supports, bumpers, floor guides, and accessories indicated.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.31 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- thick [**aluminum**] [**brass**] [**bronze**] [**stainless steel**]; with manufacturer's standard machine or self-tapping screw fasteners.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Kick Plates: 10 inches high by door width with allowance for frame stops.

2.32 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.33 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.34 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:
    a. Wood or Machine Screws: For the following:
        1) Hinges mortised to doors or frames[**; use threaded-to-the-head wood screws for wood doors and frames**].
        2) Strike plates to frames.
        3) Closers to doors and frames.
    b. Steel Through Bolts: For the following unless door blocking is provided:
        1) Surface hinges to doors.
        2) Closers to doors and frames.
        3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.35 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examination: Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

1. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation:

1. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
2. Wood Doors: Comply with door and hardware manufacturers' written instructions.

C. Mounting Heights: Mount door hardware units at heights [**indicated on Drawings**] [**to comply with the following**] unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

E. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

F. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

G. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as [**indicated in keying schedule**] [**directed by Owner**].
2. Furnish permanent cores to Owner for installation.

H. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

1. Key Lock Boxes: Install where indicated or approved by Architect to provide controlled access for fire and medical emergency personnel.
2. Key Control System Software: Set up multiple-index system based on final keying schedule.

I. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, [**above accessible ceilings**] [**in equipment room**]. Verify location with Architect.

1. Configuration: Provide [**one power supply for each door opening**] [**least number of power supplies required to adequately serve doors**] with electrified door hardware.

J. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 9200 "Joint Sealants."

K. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

L. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

M. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

N. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.2 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately [**three**] [**six**] <**Insert number**> months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.3 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include [**six**] [**nine**] [**12**] <**Insert number**> months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.4 DEMONSTRATION

A. [**Engage Installer to train**] [**Train**] Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.5 DOOR HARDWARE SCHEDULE

Hardware Set No. <#>

3 Hinges
1 Self-Closing Hinge
1 Pivots
1 Continuous Barrel Hinge
1 Continuous Gear Hinge
1 Bored Lock
1 Mortised Lock
2 Interconnected Locks
1 Roller Latch
1 Push/Pull Latch
1 Bored Auxiliary Lock
1 Mortise Auxiliary Lock
1 Narrow Stile Auxiliary Lock
1 Push-Button Combination Lock
1 Electric Strike
1 Electromagnetic Lock
1 Delayed-Egress Electromagnetic Lock
1 Electromechanical Lock
1 Self-Contained Electronic Lock
1 Exit Lock and Exit Alarm
2 Surface Bolts
2 Manual Flush Bolts
2 Automatic Flush Bolts
1 Exit Device
1 Lock Cylinder
1 Operating Trim
1 Coordinator
1 Astragal
1 Surface Closer
1 Concealed Closer
1 Closer Holder Release Device
1 Stop
1 Mechanical Holder
1 Electromagnetic Holder
1 Overhead Stop
1 Door Gasketing
1 Door Bottom
1 Threshold
1 Sliding Door Hardware
1 Folding Door Hardware
1 Metal Protective Trim
1 Plastic Protective Trim

- Balance of weatherstripping specified elsewhere.

END OF SECTION 08 7100

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. Section 08 8700 “Architectural Window Film” for decorative films applied to interior glass, see Interiors drawing sheets, including Material Selection Schedule and Finish Plans
2. Section 08 8813 "Fire-Rated Glazing."
3. Section 08 8853 "Security Glazing."

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.

D. Preconstruction adhesion and compatibility test report.

E. Sample warranties.

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 and coated 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: As indicated on Drawings.
   a. Wind Design Data: As indicated on Drawings.
   b. Importance Factor: 1.0.

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.

E. Acoustic Performance:

1. Interior Glazing for LG-1: 35 STC.
2. Interior Glazing for LG-2: 36 STC

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. 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. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

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 hot-melt butyl 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 MONOLITHIC GLASS SCHEDULE

A. Clear Glass Type (GL-1): Fully tempered float glass.

1. Minimum Thickness: 6 mm.
2. Safety glazing required.

3.6 LAMINATED GLASS SCHEDULE

A. Clear Laminated Glass Type (LG-1): Two plies of annealed float glass. Total thickness 1/4 inch. Maximum size of glass pane 15 square feet.

1. Minimum Thickness of Each Glass Ply: 3 mm.
2. Interlayer Thickness: 0.030 inch.
3. STC Rating: 35 min
4. Maximum size: 15 square feet, max 48 inches wide, max 84 inches high Safety glazing required.

B. Clear Laminated Glass Type (LG-2): Two plies of heat strengthened float glass. Total thickness 3/8 inch

1. Basis-of-Design Product:
2. Minimum Thickness of Each Glass Ply: . 3/16 inch
3. Interlayer Thickness: 0.030 inch.
4. STC Rating: 36 min
5. Safety glazing required.

3.7 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. Low-E Coating: Sputtered on second surface.
   a. Products: One of the following:
      1) AGC Glass Company North America; Energy Select 28.
      2) Guardian Industries Corp., Sunguard; SNX 62/27.
      3) Viracon, Inc.; VNE 63.
      4) Vitro Architectural Glass; Solarban 72.
7. Winter Nighttime U-Factor: 0.25 maximum.
8. Summer Daytime U-Factor: 0.22 maximum.
9. Visible Light Transmittance: 60 percent minimum.
10. Solar Heat Gain Coefficient: 0.29 maximum.
11. Safety glazing required.

3.8 INSULATING-LAMINATED-GLASS SCHEDULE

A. Clear Insulating, Laminated Glass Type (IG-2) Indoor for acoustic use in sliding panels at Learning Studios.:

1. Basis-of-Design Product: Viracon Insulating Laminated Glass Construction 1-1/8 inch overall = 1/4 inch tempered glass, 7/16 inch air space, 3/16 inch heat strengthened glass, 0.030 PVB interlayer, 3/16 inch heat strengthened glass, STC 41 .
2. Overall Unit Thickness: 1-1/8 inch.
3. Minimum Thickness of Outdoor Lite: 6 mm.
4. Outdoor Lite: Clear fully tempered float glass.
5. Interspace Content: Air.
6. Indoor Lite: Clear laminated glass with two plies of heat-strengthened float glass.
   a. Minimum Thickness of Each Glass Ply: 4 mm.
   b. Interlayer Thickness: 0.030 inch.
7. Safety glazing required.

3.9 GLAZING SCHEDULE

A. Exterior Openings: Install with glazing gaskets unless indicated otherwise. Provide insulating glass IG-1 unless indicated otherwise.

1. Safety Glass: all glass.
2. Storefronts and curtainwalls: IG-1
3. Storefronts and curtainwalls: Insulated Panels (IP-_) where noted on elevations, see Aluminum Framed Entrances and Storefronts specification section.

B. Interior Openings: Install with sealant unless indicated otherwise. Provide safety glass, GL-1 or LG-1 unless indicated otherwise.

1. Sliding aluminum framed glass doors (mall fronts) at Learning Centers: IG-2
2. Fire-Rated Openings and Assemblies: Refer to Section 08 8813 "Fire-Resistant Glazing."
3. Safety Glass: All glass shall be safety rated. Where safety glass is scheduled, provide GL-1, LG-1 or LG-2

END OF SECTION 08 8000

SECTION 08 8413 - DECORATIVE PLASTIC GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Decorative laminated plastic glazing.

B. Related Requirements:

1. Section 06 6116 “Solid Surfacing Fabrications” for attachment to counter/sill surface.
2. Section 12 3661.16 “Solid Surfacing Countertops”.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each color, pattern, and finish of plastic glazing indicated.

C. Plastic Glazing Schedule: Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For plastic glazing to include in maintenance manuals.

1.4 WARRANTY

A. Manufacturer’s Special Warranty on Plastic Fabrications: Manufacturer’s standard form agreeing to repair or replace units that fail in material or workmanship within the specified warranty period.

1. Warranty Period: 2 year after the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PLASTIC GLAZING, GENERAL

A. Glazing Publication: Comply with published instructions of plastic glazing manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

B. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.

2.2 LAMINATED DECRORATIVE GLAZING

A. Resin Panel (RP-2, -3, -4): Assembly of two sheets of polyester resin sheets laminated together with decorative interlayer as follows:

1. Product: Subject to compliance with requirements, provide 3form Inc.; Varia.
2. Overall Thickness: 3/8 inch.
3. Profile: Shelving Curve Collection.
4. Shelf Depth: As indicated on Drawings.
5. Polyester Resin Sheets:

    a. Product: Subject to compliance with requirements, provide 3form Inc.; Ecoresin.
    b. Thickness: 3/16 inch.
    c. Color: Clear.
    d. Surface Texture: Vellum F04.

6. Interlayer: Clear interlayer compatible with polyesters and bonding process to create a monolithic sheet of material when complete as follows:
    a. Pattern: Solid.

    b. Pattern Colors: As indicated in Material Selection Schedule.

2.3 MOUNTING HARDWARE

A. Wall-Top Channel Mounting: Support for cantilever mounting of vertical panel on wall top.

1. Product: Subject to compliance with requirements, provide 3form; Fin Partition.
2. Material and Finish: Aluminum with clear anodized finish.

B. Suspended Mounting Hardware: Suspended partition fastened top and bottom of panel.

1. Product: Subject to compliance with requirements, provide 3form Ready-to-Go Solutions; Partitions 200.10.

C. Shelf Mounting Hardware: Adjustable tension cable system consisting of cable, couplers, tensioners, and shelf holders as follows:

1. Product: Subject to compliance with requirements, provide 3form; Suspend.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of plastic glazing materials, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publication.

B. Sand or scrape cut edges of plastic glazing to provide smooth edges, free of chips and hairline cracks.

C. Protect plastic glazing surfaces from abrasion and other damage during handling and installation, according to the following requirements:

1. Retain plastic glazing manufacturer's protective covering or protect by other methods according to plastic glazing manufacturer's written instructions.
2. Remove covering at border of each piece before glazing; remove remainder of covering immediately after installation where plastic glazing is exposed to sunlight or where other conditions make later removal difficult.

3.2 CLEANING AND PROTECTION

A. Protect plastic glazing from contact with contaminating substances from construction operations. If, despite such protection, contaminating substances do come into contact with plastic glazing, remove immediately and wash plastic glazing according to plastic glazing manufacturer's written instructions.

B. Remove and replace plastic glazing that is damaged during construction period.

END OF SECTION 08 8413

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SECTION 08 8700 – ARCHITECTURAL WINDOW FILM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes architectural window films with frosted gradient pattern for use on interior glass storefront, and other glazing where indicated on drawings.

B. Related Requirements:

1. Section 08 1416 "Flush Wood Doors"
2. Section 08 8000 "Glazing"

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's current technical literature on each product to be used, including:

1. Manufacturer's Data Sheets.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

B. Shop Drawings: Include floor plans showing extents of film installation, elevations of typical film installation height and details.

C. Samples for Verification: For each film type specified, (3) samples showing the full roll width of actual film color and pattern, each sample to show full pattern repeat at least 30” wide.

D. Mockups: One mockup of actual film sample to be installed on site for review and approval of pattern and installation quality by architect before proceeding.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Manufacturer & Installer.

B. Product Certificates: For each type of film.

1.4 WARRANTY

A. At project closeout, provide to Owner or Owner's Representative an executed current copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DECORATIVE FROSTED GRADIENT FILM

A. Product: as indicated by manufacturer's designation on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Clean surfaces thoroughly prior to installation

B. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. Film Installation, General:

1. Install in accordance with manufacturer's instructions.
2. Cut film edges neatly and square at a uniform distance of 1/16 inch (1.5 mm) of window sealant. Use new blade tips after 3 to 4 cuts.
3. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.
4. Apply film to glass and lightly spray film with slip solution.
5. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
6. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
7. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.

3.4 CLEANING AND PROTECTION

A. Remove left over material and debris from Work area. Use necessary means to protect film before, during, and after installation.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

END OF SECTION 08 8700

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SECTION 08 8813 - FIRE-RATED GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection-rated glazing.
2. Fire-resistance-rated glazing.

B. Related Requirements:

1. Section 08 8000 “Glazing” for non-security rated glass
2. Section 08 8700 “Architectural Window Film” for decorative films applied to interior glass, see Interiors drawing sheets, including Material Selection Schedule and Finish Plans
3. Section 08 8853 “Security Glazing” for fire rated glazing that may also have security 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.

1.3 ACTION SUBMITTALS

A. Combined Submittals: All submittals in this section must be submitted in one package together with Section 08 8853 “Security Glazing”.

B. Product Data: For each type of product.

C. Glass Samples: For each type of glass product; 12 inches square.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers.

B. Product Certificates: For each type of glass and glazing product, from manufacturer.

C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. 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.

1.6 WARRANTY

A. Manufacturer's Special Warranty on 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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.2 GLASS PRODUCTS, GENERAL

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

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

B. Safety Glazing Labeling: Permanently mark glazing with certification label of the Safety Glazing Certification Council. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.3 GLASS PRODUCTS

A. Ultraclear (Low Iron) Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear), with visible light transmission not less than 91 percent.

B. Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.

C. 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.

2.4 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.

1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test.

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F temperature-rise limitation; and the fire-resistance rating in minutes.

C. Fire-Protection Rated Glass (FPG-2): For one-hour fire rated occupancy and atrium separation walls provide 45 minute rated glass D-H-45 for doors, sidelights and windows. Provide One of the following:

1. Laminated Ceramic Glazing: . Laminated glass made from two plies of clear, ceramic glass; 8-mm total thickness; and complying with 16 CFR 1201, Category II.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) SAFTI FIRST Fire Rated Glazing Solutions; SuperClear 45-HS.
      2) Schott North America, Inc.; Pyran Platinum L.
      3) Technical Glass Products; FireLite Plus.

2. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, ultraclear float glass, 19 mm total thickness; with intumescent interlayers; and complying with 16 CFR 1201, Category II.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) McGrory Glass: AGC Pyrobel 45
      2) SAFTI FIRST Fire Rated Glazing Solutions; SuperClear 45-HS.
      3) McGrory Glass, Pyran Platinum L

2.5 FIRE-RESISTANCE-RATED GLAZING

A. Fire-Resistance-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-resistance ratings indicated, based on testing according to ASTM E119 or UL 263.

B. Fire-Resistance-Rated Glazing Labeling: Permanently mark fire-resistance-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, that the glazing is approved for use in walls, and the fire-resistance rating in minutes.

C. Laminated or Tempered Glass with Intumescent Interlayers (FRG-1): For glass in stairway enclosure doors over 100 square inches and all sidelights and transoms in stairway enclosures. Fire Rated Glazing Marking D-H-W. Match wall fire rating. Laminated glass made from multiple plies of uncoated, ultraclear float glass; with intumescent interlayers; and complying with 16 CFR 1201, Category II.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. McGrory Glass, Inc: Pyrobel
   b. Pilkington North America; Pyrostop.

c. SAFTI FIRST Fire Rated Glazing Solutions; SuperLite II-XLM or XL.
d. Technical Glass Products; Pyrostop.
e. Vetrotech Saint-Gobain; Contraflam.

2. Provide fire rated frames to suit glazing thickness or confirm that frames shown and specified will meet all requirements.

2.6 GLAZING ACCESSORIES

A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. GE Construction Sealants; Momentive Performance Materials Inc.; SilGlaze II SCS2800.
   b. The Dow Chemical Company; Dow Corning® 795 Silicone Building Sealant.
   c. Tremco Incorporated; Spectrem 2.

2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. 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.

C. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

PART 3 - EXECUTION

3.1 GLAZING

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. 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.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. 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.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Remove and replace glass that is damaged during construction period.

3.3 FIRE-RATED GLAZING SCHEDULE

A. Fire-Protection-Rated Glazing:

1. Provide glazing thickness as required to achieve ratings indicated on Drawings for glass sizes indicated.
2. Where FPG-1 is indicated on Drawings, provide FPG-1 or FRG-1
3. Where FPSG-1 is indicated on drawings, provide FPG-1 or FRG-1 that also meets SG-1 Security Glazing Requirements, Refer to Section 08 8853 “Security Glazing”
4. Where FPSG-3 is indicated on drawings, provide FPG-1 or FRG-1 that also meets SG-3 Security Glazing Requirements, Refer to Section 08 8853 “Security Glazing”

B. Fire-Resistance-Rated Glazing:

1. Provide glazing thickness as required to achieve ratings indicated on Drawings for glass sizes indicated.
2. Where FRG-1 is indicated on Drawings, provide FRG-1

END OF SECTION 08 8813

SECTION 08 8853 - SECURITY GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Laminated-glass security glazing
2. Insulating security glazing.

B. Related Requirements:

1. Section 08 8000 “Glazing” for non-security rated glass
2. Section 08 8700 “Architectural Window Film” for decorative films applied to interior glass, see Interiors drawing sheets, including Material Selection Schedule and Finish Plans
3. Section 08 8813 “Fire-Rated Glazing” for security glazing that may also have a fire rating.

1.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on security glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for security glazing during and after installation.

1.4 ACTION SUBMITTALS

A. Combined Submittals: All submittals in this section must be submitted in one package together with Section 08 8813 Fire Rated Glazing.

B. Product Data: For each type of product.

C. Samples for Verification:

1. Glazing: Actual sample of finished products for each type of security glazing.
   a. Size: Manufacturers' standard size.

D. Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.

E. Delegated Design Submittal: For security glazing, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports:
   a. For each type of security glazing, for tests performed by qualified testing agency.

2. Preconstruction Test Reports: For preconstruction adhesion and compatibility testing.

B. Sample warranties.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: For insulating or air-gap security glazing units with sputter-coated, low-e coatings, a qualified insulating glazing manufacturer who is approved[**and certified**] by coated-glass manufacturer.
2. Installers: Entity that employs installers and supervisors who are trained and approved by manufacturer.
3. Delegated Design Engineer: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of type indicated.
4. Security Glazing Testing Agency: Subject to compliance with requirements, testing agency is one of the following:
   a. Intertek.
   b. Underwriters Laboratories, Inc.
   c. Wiss, Janney, Elstner Associates, Inc.

5. Sealant Testing Agency: An independent testing agency qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.7 WARRANTY

A. Special Warranty, Coated Glass: Manufacturer agrees to replace coated glass that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Defects developed in coated glass from normal use that is 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.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Warranty, Laminated-Glass Security Glazing: Manufacturer agrees to replace laminated-glass security glazing that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated-glass security glazing 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.

2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Warranty, Insulating Security Glazing: Manufacturer agrees to replace insulating security glazing that fails in materials and workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Defects in individual lites developed from normal use or failure of hermetic seal under normal use. Defects in individual lites or failure of hermetic seal that is attributed to glass breakage or to maintaining and cleaning insulating security glazing contrary to manufacturer's written instructions are not included.
   b. Defects in coated-glass lites include peeling, cracking, and other indications of deterioration in coating.
   c. Defects in laminated-glass lites include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   d. Defects in glass-clad polycarbonate lites include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
   e. Evidence of hermetic seal failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glazing.

2. Warranty Period: 10 years from date of Substantial Completion.

D. Special Warranty, Air-Gap Security Glazing: Manufacturer agrees to replace air-gap security glazing that fails in materials and workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Defects in individual lites developed from normal use or failure of hermetic seal under normal use. Defects in individual lites or failure of hermetic seal that is attributed to glass breakage or to maintaining and cleaning air-gap security glazing contrary to manufacturer's written instructions are not included.
   b. Defects in coated-glass lites include peeling, cracking, and other indications of deterioration in coating.
   c. Defects in laminated-glass lites include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   d. Defects in laminated-polycarbonate lites include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced standard, yellowing, and loss of light transmission.

e. Evidence of hermetic seal failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glazing.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General:

1. Installed security glazing will withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
2. Installed security glazing will withstand security-related loads and forces without damage to the glazing beyond that allowed by referenced standards.

B. Delegated Design: Engage a qualified professional engineer, licensed to practice in the state where the project is located to design security glazing.

C. Structural Performance: Glazing will withstand the following design loads within limits and under conditions indicated.

1. Design Procedure for Glass: ASTM E1300 and the IBC.
2. Design Wind Pressures: As indicated on Drawings.
   a. Wind Design Data: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

E. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

F. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.2 SECURITY GLAZING, GENERAL

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

1. IGMA Publication for Insulating Glass: SIGMA TM-3000.
2. NGA Publications: "Laminated Glazing Reference Manual" and "GANA Glazing Manual."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction. Label will indicate manufacturer's name, type of glazing, glass thickness, and safety glazing standard with which glazing complies.

C. Insulating Glazing Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the Insulating Glass Certification Council.

D. Thermal and Optical Performance Properties: Provide security glazing with performance properties specified, as indicated in manufacturer's published test data, based on construction products indicated and 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 7.7 computer program.
3. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS

A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

C. Chemically Strengthened Glass: Annealed float glass is chemically strengthened to comply with ASTM C1422/C1422M, Surface Compression and Case Depth. to meet manufacturers requirements for performance specified

2.4 LAMINATED-GLASS SECURITY GLAZING

A. Products: Subject to compliance with requirements, provide one of the following:

1. Global Security Glazing; Isoclima Specialty Glass, LLC.; Childgard, 6 minute attack Insert product designation.
2. McGrory Glass, Inc; Forced Entry/Assault-Resistant, DefendED™, 14 minute attack .
3. LTI Smart Glass, School Guard SG4, 6 minute attack

B. Laminated-Glass Security Glazing: ASTM C1172. Two or more glass lites bonded with interlayer. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
2. Interlayer Color: Clear unless otherwise indicated.

2.5 INSULATING SECURITY GLAZING

A. Products: Subject to compliance with requirements, provide one of the following:

1. Global Security Glazing; Consolidated Glass Holdings, Inc.; Childgard <Insert product designation>.
2. McGrory Glass, Inc; Forced Entry/Assault-Resistant, DefendED™ .

3. Thompson IG, LLC SchoolDefender 1 IG, Ballistic Level 1

B. Insulating Security Glazing: Factory-assembled units, consisting of sealed lites of glazing material indicated 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. Spacer: Nonmetallic laminate or Nonmetallic tube.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

2.6 AIR-GAP SECURITY GLAZING

A. Products: Subject to compliance with requirements, provide one of the following:

B. Global Security Glazing

C. Air-Gap Security Glazing: Factory-assembled units, consisting of sealed lites of glazing material indicated separated by a dehydrated interspace.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer Specifications: Manufacturer's standard[**rigid**] spacer material and construction.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, 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 security glazing manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of Industry colors.

B. Glazing Sealant:

1. Neutral-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Polymeric Systems, Inc. PSI-631
      2) Sika Corporation. Bondaflex Sil 201 FC
      3) Tremco Incorporated. Tremsil 600
   b. Applications: Interior Glazing.

C. Security Sealant: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with low movement complying with ASTM C920, Grade NS, Class 12.5 or 25, Use NT, and with a Shore A hardness of at least 45 when tested in accordance with ASTM C661.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Master Builders Solutions. MasterSeal CR 195 (formerly Sonolastic Ultra)
   b. Pecora Corporation, DynaFlex.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of security glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. EPDM or Silicone with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by security glazing manufacturer to maintain security glazing lites in place for installation indicated.
2. Type recommended in writing by sealant or security glazing manufacturer.

E. Edge Blocks:

1. EPDM or Silicone with Shore A durometer hardness in accordance with manufacturer's written instructions.
2. Type recommended in writing by sealant or security glazing manufacturer.

F. 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 SECURITY GLAZING

A. Fabricate security glazing 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing for security glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Minimum required bite.
5. Effective sealing between joints of framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of it off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and 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 glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.

F. Provide spacers for security glazing lites where the length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of security glazing. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness of slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and in accordance with requirements in referenced glazing publications.

H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set coated security glazing with proper orientation so that coatings and films 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.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended in writing by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glazing unit 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 security glazing 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 security glazing. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center security glazing 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 security glazing. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. 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 security glazing and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from security glazing.

3.6 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. Examine security glazing 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 security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace security glazing that cannot be cleaned without damage.

C. Wash security glazing on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

3.7 LAMINATED-GLASS SECURITY GLAZING SCHEDULE

A. Security Glazing Type SG-1: Clear laminated glass .

1. Basis-of-Design Product: School Guard SG4 or ChildGard or McGrory DefendED
2. Forced-Entry Resistance, ASTM F1233: Class 1.3 in accordance with ASTM F1233.
3. Forced-Entry Resistance, HP White 5-aa1: 6 minutes
4. Maximum Overall Unit Thickness: 1/2 inch.
5. Overall Visible Light Transmittance: 84% minimum.
6. Outdoor Visible Reflectance: 15% maximum percent maximum.
7. Provide safety glazing labeling.

B. Security Glazing Type SG-3: Bullet Resistant. Laminated glass with clear glass and clear interlayer. An air gap is permitted.

1. Basis-of-Design Product: McGrory BallisticDefend 1-GCP, LTI Smartgard BR1 or Thompson IG SchoolDefender 1-IG .
2. Forced-Entry Resistance, ASTM F1233: Class 1.3 in accordance with ASTM F1233.
3. Ballistic Resistance, UL 752: Level 1 in accordance with UL 752.
4. Maximum Overall Unit Thickness: 1.125 inch.
5. Interlayer Color: Clear.
6. Overall Visible Light Transmittance: 60 percent minimum .
7. Provide safety glazing labeling.

3.8 INSULATING SECURITY GLAZING SCHEDULE

A. Security Glazing Type SG-2 : Low-e-coated, clear insulating security glazing. Outdoor lite is made of tempered glass, and indoor lite is made of laminated glass.

1. Basis-of-Design Product: School Guard SG4 or ChildGard or McGrory DefendED.
2. Forced-Entry Resistance, ASTM F1233: Class 1.3 in accordance with ASTM F1233.
3. Forced-Entry Resistance, HP White 5-aa1: 6 minutes
4. Overall Unit Thickness: 1.0 to 1.5 inches, manufacturer to verify.
5. Interspace Content: Argon.
6. Low-E Coating: Pyrolytic on second surface Sputtered on second surface.
7. Overall Visible Light Transmittance: 60 percent minimum.
8. Winter Nighttime U-Factor: 0.25 maximum.
9. Summer Daytime U-Factor: 0.22 maximum.
10. Solar-Heat-Gain Coefficient: 0.29 maximum.
11. Provide safety glazing labeling.

3.9 GLAZING SCHEDULE

A. Security Rated Glazing:

1. Provide glazing thickness as required to achieve ratings indicated on Drawings for glass sizes indicated.
2. Where SG-1 is indicated on the drawings, provide SG-1, SG-2 or SG-3.
3. Where SG-2 is indicated on the drawings, provide SG-2.
4. Where SG-3 is indicated on the drawings, provide SG-3.
5. Where FPSG-1 is indicated on drawings, provide SG-1, SG-2 or SG-3. The provided glass must also meet FPG-1 or FRG-1, Refer to Section 08 8813 “Fire-Rated Glazing”.
6. Where FPSG-3 is indicated on drawings, provide SG-3 that also meets FPG-1 or FRG-1, Refer to Section 08 8813 “Fire-Rated Glazing”

END OF SECTION 08 8853

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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. Section 08 1113 "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.
2. Section 08 1416 "Flush Wood Doors" for louvers in flush wood doors.

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: Five 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. 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.

C. 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(Louvers 25 square feet and below):

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. Construction Specialties, Inc.
   d. Greenheck Fan Corporation.
   e. Industrial Louvers Inc.
   f. Ruskin Company.

2. Louver Depth: 6 inches.
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.

B. Horizontal, Wind-Driven-Rain-Resistant Louver Louvers over 25 square feet :

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. Construction Specialties, Inc.
   d. Greenheck Fan Corporation.
   e. Industrial Louvers Inc.
   f. Ruskin Company.

2. Louver Depth: 7 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.
4. Intermittent Mullions: Concealed.
5. Louver Performance Ratings:
   a. Free Area: Not less than 8.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
   b. Air Performance: Not more than 0.10-inch wg static pressure drop at 700-fpm free-area intake velocity.
   c. Wind-Driven Rain Performance: Not less than 95 percent effectiveness when subjected to a rainfall rate of 3 inches per hour and a wind speed of 29 mph at a core-area intake velocity of 300 fpm.
6. 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 type of finish applied to louvers, but black color.
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 Phillips flat-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

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. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

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. If wall is shown with an air gap, do not span the gap with bridging or any components. If bracing is unavoidable use Mason DNSB resilient braces.

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: 0.0269 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, 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.

F. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Kinetics Isomax
2. PAC International RSIC-1
3. Configuration: Asymmetrical.

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.

C. Sound Isolation Clips: Provide the following:

1. Kinetics Noise Control; Iso-Max Sound Isolation Clips.

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. Sound-Rated Partitions: The stud runner channels at the top and bottom of the wall must overlap or “nest’ to prevent gaps between sections of runner channel.
7. 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.
2. Tile backing panels.

B. Related Requirements:

1. Section 06 1600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 07 9219 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
3. 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 QUALITY ASSURANCE

A. Installer Qualifications

1. Must be experienced in the installation of systems similar to those specified herein
2. Installer must review and understand the Gypsorb Principles of Installation manual found at http://www.gypsorb.com/technical-info/ as well as consult with the Gypsorb, LLC technical department to review the Sonus and Strata systems prior to bidding.

1.4 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.

1.5 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 or ASTM C423 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.
3. Density: 2.2 lbs/sq. ft. minimum

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.

2. USG Corporation; Mold Tough VHI Abuse-Resistant Panels.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 SPECIALTY GYPSUM BOARD

A. Perforated Gypsum Board: ASTM C 1396/C 1396M. High density gypsum board with continuous sound absorbing perforations, random round perforations.

1. Products: Subject to compliance with requirements, provide the following:
   a. Gypsorb, LLC, Strata 8-15-20, Basis of Design.
      1) With Armstrong Metric DGS Framing for Strata, and GypSorb Blocking Assembly
      2) Provide 2 inch fiberglass batt on top of panels.

2. Core: 1/2 inch, Type X.
3. Long Edges: Tapered.
4. Open area: 9.8 percent
5. Weight 2.05 lbs per sf
6. Acoustic properties: NRC 70

2.5 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corporation; GlasRoc Tile Backer.
   b. Georgia-Pacific Building Products; DensShield Tile Backer.
   c. National Gypsum Company; eXP Tile Backer.
   d. Temple-Inland Building Products by Georgia-Pacific; Green Glass Tilebacker.
   e. USG; Durock Brand Glass-Mat Tile Backerboard.

2. Core: 5/8 inch, Type X.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 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.

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. Fry Reglet Corporation.
   b. Gordon Inc.
   c. Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 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.

2.8 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.

a. All gaps between panels shall be 1/4 to 1/2 inch wide and sealed airtight with acoustical sealant.

b. Recessed electrical devices shall not be back to back, offset devices 24 inches minimum. If not offset, install acoustic sheet pads around device boxes. Kinetics Noise Control IsoBacker or QuietRock Quiet Putty.

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.
4. Impact-Resistant Type: As indicated on Drawings.
5. Tile Backing Panels: Locations to receive tile.

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. Applying Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.
2. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

H. 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 unless otherwise indicated.
   b. LC-Bead: Use at exposed panel edges.
   c. L-Bead: Use where indicated.
   d. U-Bead: Use at exposed panel edges.
   e. Curved-Edge Cornerbead: Use at curved openings.

3. Aluminum Trim: Install in locations indicated on Drawings.

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 or are curved and other locations indicated on Drawings.
   a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."

E. Perforated gypsum finishing:

1. Utilize the “Joint Filling Technique” for Gypsorb - supplied separately. Ensure that all required jointing equipment, accessories and tools are available prior to commencing installation of the board.

   a. Uniflott by Gypsorb / Knauf

b. Ready Mix Joint Compound Inserts

2. Prime Painting

a. APPLY BY ROLLER ONLY (1/4" nap)
b. One prime coat

3. Finish painting

a. APPLY BY ROLLER ONLY (1/4" nap)
b. Two finish coats

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

SECTION 09 3000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic mosaic tile.
2. Porcelain tile and base.
3. Glazed wall tile.
4. Waterproof membrane.
5. Metal edge strips.

B. Related Requirements:

1. Section 07 9200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 09 2900 "Gypsum Board" for glass-mat, water-resistant backer board.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Metal edge strips in 6-inch lengths.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Experienced installer with a record of successful installations using types of materials specified.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified portland cement and aggregate, from single manufacturer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Waterproof membrane.
2. Cementitious backer units.
3. Metal edge strips.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.3 CERAMIC TILE PRODUCTS

A. Porcelain Tile Types and Base types: As noted in the Material Selection Schedule on drawings and on the Finish Plan Drawings.

B. As indicated on Material Selection Schedule.Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as as indicated on Drawings.

2.4 WATERPROOF MEMBRANE

A. Waterproofing Membranes for Thin-Set Tile Installations: Manufacturer's standard product that complies with ANSI A118.10, selected from the following.Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
    b. Laticrete International, Inc; Laticrete 9235 Waterproof Membrane.
    c. MAPEI Corporation; Mapelastic HPG with Mapei Fiberglass Mesh.
    d. TEC; HB Fuller Construction Products, Inc.; HydraFlex Waterproofing Crack Isolation Membrane.

2.5 SETTING MATERIALS

A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Bostik, Inc.
    b. Custom Building Products.
    c. Laticrete International, Inc.
    d. MAPEI Corporation.
    e. TEC; H.B. Fuller Construction Products Inc.

2. Provide prepackaged, dry-mortar mix combined with liquid-latex additive at Project site.
3. For wall applications, provide nonsagging mortar.

2.6 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7. Provide with manufacturer's recommended grout release additive.

B. Products: Subject to compliance with requirements, provide one of the following:

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

1. Custom Building Products.
2. Laticrete International, Inc.; Permacolor Select.
3. MAPEI Corporation; Premixed Premium Grout
4. TEC; H.B. Fuller Construction Products Inc.; Power Grout.

D. Grout Colors: Match colors indicated on Material Selection Schedule.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips at Flooring Terminations: Shape and finish as indicated on Drawings.

C. Metal Corner Strips: For outside corners where porcelain pavers are installed on wall, provide the profile shape and finish as indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
   a. Tile floors in wet areas.
   b. Tile floors consisting of tiles 8 by 8 inches or larger.
   c. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

G. Install tile on floors with the following joint widths:

1. Ceramic Mosaic Tile: 1/8 inch (3.2 mm).
2. Porcelain Tile: 3/16 inch (4.7 mm).

H. Install tile on walls with the following joint widths:

1. Ceramic Mosaic Tile: 1/8 inch (3.2 mm)
2. Porcelain Tile: 1/8 inch (3.2 mm).

I. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

J. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

K. Metal Edge Strips: Install at locations indicated on Drawings..

L. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Interior floor installation on waterproof membrane over concrete; thin-set mortar; TCA F122.

a. Bond Coat/Thin-Set Mortar: Latex-portland cement mortar.
b. Grout: Polymer-modified unsanded grout for joints narrower than 1/8 inch (3 mm) and polymer-modified sanded grout for joints wider than 1/8 inch (3 mm).

B. Interior Wall Installations, Masonry or Concrete:

1. Interior wall installation over masonry or concrete; thin-set mortar; TCNA W202.

a. Thinset Mortar: Latex-portland cement mortar.
b. Grout: Polymer-modified unsanded grout for joints narrower than 1/8 inch (3 mm) and polymer-modified sanded grout for joints wider than 1/8 inch (3 mm).

2. Interior wall installation over glass-mat, water-resistant backer board; thin-set mortar; TCA W245.

a. Thinset Mortar: Latex-portland cement mortar.
b. Grout: Polymer-modified unsanded grout for joints narrower than 1/8 inche (3 mm) and polymer-modified sanded grout for joints wider than 1/8 inch (3 mm).

C. Interior Wall Installations, Wood or Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W245 or TCNA W248; thinset mortar on glass-mat, water-resistant gypsum backer board.

a. Thinset Mortar: Latex-portland cement mortar.
b. Grout: Polymer-modified unsanded grout for joints narrower than 1/8 inch (3 mm) and polymer-modified sanded grout for joints wider than 1/8 inch (3 mm).

END OF SECTION 09 3000

SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

B. Related Requirements:

1. Section 09 5123 "Acoustical Tile Ceilings" for ceilings consisting of mineral-base acoustical tiles used with fully concealed suspension systems, stapling, or adhesive bonding.
2. Section 09 5133 "Acoustical Metal Pan Ceilings" for ceilings consisting of metal-pan units with exposed and concealed suspension systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For each acoustical panel ceiling suspension system, from ICC-ES.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. For standard Acoustical Ceiling Units (ACP-1, ACP-4 and ACP-5): Full-size panels equal to 2 percent of quantity installed.
2. For custom colored Acoustical Ceiling Units (ACP-2 & ACP-3): Full-size panels equal to 5 percent of quantity installed.
3. Suspension-System Components (tees and mains) for custom colored Acoustical Ceiling Units (ACP-2 & ACP-3) Quantity of each exposed component equal to 5 percent of quantity installed.
4. Hold-Down Clips: Equal to 2 percent of total quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.

2.2 ACOUSTICAL PANELS

A. Acoustic Panel Ceiling: Subject to compliance with requirements, provide products indicated on Drawings.

2.3 ACOUSTICAL PANELS

A. Acoustic Panel Ceiling (ACP-1): Provide manufacturer's standard panels complying with Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face according to ASTM E 1264 and, pattern, acoustical rating, and light reflectance unless otherwise indicated.

1. Product: Subject to compliance with requirements, provide one of the following:
   a. Armstrong Ceiling and Wall Solutions: Ultima High-NRC, #1941.
   b. CertainTeed Corporation: Symphony m 80 Rx.
   c. Rockfon (Roxul Inc.): Alaska SLT.
   d. United States Gypsum Company: Mars High-NRC.
2. Color: As indicated on Drawings.
3. Light Reflectance (LR): Not less than 0.85.
4. Ceiling Attenuation Class (CAC): Not less than 35.
5. Noise Reduction Coefficient (NRC): Not less than 0.80.
6. Articulation Class (AC): Not less than 170 .
7. Edge/Joint Detail: Beveled Tegular.
8. Thickness: 7/8 inch.
9. Modular Size: 24 by 24 inches.
10. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold,

mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

B. Acoustic Panel Ceiling (ACP-2 & ACP-3): Provide manufacturer's standard fire-resistance-rated panels complying with Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with according to ASTM E 1264 and, pattern, acoustical rating, and light reflectance unless otherwise indicated.

1. Product: Subject to compliance with requirements, provide one of the following:
   a. Armstrong Ceiling and Wall Solutions: Calla, #2820.
   b. Rockfon (Roxul Inc.): Color-all.
   c. United States Gypsum Company: Mars High-NRC.

2. Colors: As indicated in Material Selection Schedule.
3. Light Reflectance (LR): Not less than 0.85.
4. Ceiling Attenuation Class (CAC): Not less than 35.
5. Noise Reduction Coefficient (NRC): Not less than 0.85.
6. Articulation Class (AC): Not less than 170.
7. Edge/Joint Detail: Square.
8. Thickness: 1 inch.
9. Modular Size: 24 by 24 inches.
10. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.
11. Grid Type: 2. Custom color, see Material Selection Schedule.

C. Acoustic Panel Ceiling (ACP-5): Provide manufacturer's standard panels complying with Type XX, high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes according to ASTM E 1264 and, pattern, acoustical rating, and light reflectance unless otherwise indicated.

1. Product: Subject to compliance with requirements, provide the following:
   a. Rockfon (Roxul Inc.): Koral, #1100.

2. Color: White.
3. Light Reflectance (LR): Not less than 0.85 .
4. Noise Reduction Coefficient (NRC): Not less than 0.85.
5. Articulation Class (AC): Not less than 170.
6. Edge/Joint Detail: Square.
7. Thickness: 5/8 inch.
8. Modular Size: 24 by 24 inches.
9. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.
10. Grid Type: 1.

D. Acoustic Panel Ceiling (GCP-1): Provide manufacturer's standard fire-resistance-rated panels complying with Type XX, high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat,

moisture, and corrosive fumes according to ASTM E 1264 and, pattern, acoustical rating, and light reflectance unless otherwise indicated.

1. Product: Subject to compliance with requirements, provide the following:
   a. United States Gypsum Company: Sheetrock Brand Lay-in Gypsum Ceiling Panels, 3260.

2. Color: White.
3. Light Reflectance (LR): Not less than 0.75.
4. Ceiling Attenuation Class (CAC): Not less than 35.
5. Edge/Joint Detail: Square.
6. Thickness: 1/2 inch (12.7 mm).
7. Modular Size: 24 by 24 inches.
8. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.
9. Grid Type:1.

E. Acoustic Panel Ceiling (ACP-4): Provide manufacturer's standard panels complying with Type IX, Form 2 according to ASTM E 1264 and, pattern, acoustical rating, and light reflectance unless otherwise indicated.

1. Product: Subject to compliance with requirements, provide one of the following:
   a. Armstrong Ceiling and Wall Solutions: Kitchen Zone, #673.
   b. CertainTeed Corporation: Vinylshield..
   c.

2. Color: White.
3. Light Reflectance (LR): Not less than 0.85.
4. Ceiling Attenuation Class (CAC): Not less than 30 .
5. Edge/Joint Detail: Square.
6. Thickness: 5/8 inch.
7. Modular Size: 24 by 24 inches.
8. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.
9. Grid Type: 1.

2.4 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

B. Wide-Face, Capped, Double-Web, Steel Suspension System (Type-1): Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Armstrong Ceiling and Wall Solutions; Prelude ML 15/16 inch Exposed Tee System.
b. CertainTeed Corp.; 15/16 inch Classic Hook System.
c. Rockfon (Roxul Inc.); Snap Grid 200.
d. USG Interiors, Inc.; Subsidiary of USG Corporation; Donn DX.

2. Structural Classification: Intermediate-duty system.
3. End Condition of Cross Runners: Butt-edge type.
4. Face Design: Flat, flush.
5. Cap Material: Cold-rolled steel.
6. Cap Finish: White.

C. Wide-Face, Capped, Double-Web, Steel Suspension System (Type-2): Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Armstrong Ceiling and Wall Solutions; Prelude ML 15/16 inch Exposed Tee System.
   b. CertainTeed Corp.; 15/16 inch Classic Hook System.
   c. Rockfon (Roxul Inc.); Snap Grid 200.
   d. USG Interiors, Inc.; Subsidiary of USG Corporation; Donn DX.

2. Structural Classification: Intermediate-duty system.
3. End Condition of Cross Runners: Butt-edge type.
4. Face Design: Flat, flush.
5. Cap Material: Cold-rolled steel.
6. Cap Finish: Custom painted to match P-3. See Material Selection Schedule.

D. Wide-Face, Capped, Double-Web, Steel Suspension System (Type-3): Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Armstrong Ceiling and Wall Solutions; Prelude ML 15/16 inch Exposed Tee System.
   b. CertainTeed Corp.; 15/16 inch Classic Hook System.
   c. Rockfon (Roxul Inc.); Snap Grid 200.
   d. USG Interiors, Inc.; Subsidiary of USG Corporation; Donn DX.

2. Structural Classification: Intermediate-duty system.
3. End Condition of Cross Runners: Butt-edge type.
4. Face Design: Flat, flush.
5. Cap Material: Cold-rolled steel.
6. Cap Finish: Custom painted to match P-4. See Material Selection Schedule.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Hold-Down Clips: Manufacturer's standard hold-down.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. Provide trim cover pieces fabricated for inside and outside corners appropriate for adjacent construction.

B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Armstrong Ceiling and Wall Solutions; Axiom Trim.
   b. CertainTeed Corp.; Terminus or Cloud Trim.
   c. Rockfon (Roxul Inc.); Infinity Trim.
   d. USG Interiors, Inc.; Compasso Trim.

2. Profile Depth: Varies. Refer to details on Drawings.
3. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.

B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. Arrange directionally patterned acoustical panels as follows:
   a. Install panels with pattern running in one direction parallel to long axis of space.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.

3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips within 20 ft of exterior doors and in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

END OF SECTION 09 5113

SECTION 09 5423 - LINEAR METAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Linear metal ceilings.

1.2 ALLOWANCES

A. See Section 01 2100 "Allowances" for description of allowances affecting items specified in this Section.

1.3 UNIT PRICES

A. See Section 01 2200 "Unit Prices" for description of unit prices affecting items specified in this Section.

1.4 ALTERNATES

A. See Section 01 2300 "Alternates" for description of alternates affecting items specified in this Section.

1.5 COORDINATION

A. Coordinate layout and installation of linear metal pans and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For linear metal ceilings.

1. Include reflected ceiling plans, sections, and details, drawn to scale, showing the following:

a. Linear ceiling patterns and joints.
b. Ceiling suspension members.
c. Method of attaching hangers to building structure and locations of cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
d. Ceiling-mounted items including, but not limited to, light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
e. Ceiling perimeter and penetrations through ceiling; trim and moldings.

C. Samples: For each exposed product and for each type, color, and finish specified, 12 inches long in size.

D. Samples for Verification: For the following products:

1. Linear Metal Pans: 12 inches long by full-width Samples of each type, color, and finish and a 12-inch- long spliced section.
2. Suspension-System Members: 12-inch- long Sample of each type.
3. Exposed Molding and Trim: 12-inch- long Samples of each type, color, and finish.
4. Filler Strips: 12-inch- long Samples of each type, color, and finish.
5. Sound Absorbers: 12 inches long by full width.
6. End Caps: Full size.

E. Delegated Design Submittal: For design of attachment devices.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each linear metal ceiling, for tests performed by a qualified testing agency.

C. Evaluation Reports: For linear-metal-ceiling framing systems.

D. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.9 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Linear-Metal-Ceiling Components: Quantity of each pan, carrier, accessory, and exposed molding and trim equal to 2 percent of quantity installed.

1.10 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by National Voluntary Laboratory Accreditation Program for testing indicated.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver ceiling components and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Handle ceiling components and accessories in a manner that prevents damage.

1.12 PROJECT CONDITIONS

A. Environmental Limitations: Do not install interior ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

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 attachment devices.

2.2 LINEAR METAL CEILINGS

A. Refer to Drawings for product information.

2.3 LINEAR METAL CEILINGS

A. Aluminum Pans (LMC-1): Formed to snap on to carriers securely, without separate fasteners.

1. Product: Subject to compliance with requirements, provide USG Ceilings; Planx. Color and size as indicated in Material Selection Schedule.
2. Surface-Burning Characteristics: For metal-pan assemblies, including backings, determined by testing in accordance with ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 50 or less.

3. Metal: Aluminum sheet, ASTM B209, alloy and temper recommended by producer and finisher for type of use and finish indicated.
4. Form: Perforated.

    a. Perforation Pattern: To be selected from Manufacturer’s Standard options.

5. Noise Reduction Coefficient (NRC) Rating: Not less than Insert requirements 0.95 when tested in accordance with ASTM C423.
6. Backing: [Manufacturer's standard Acoustibond with Ultrasorb backers to provide NRC rating indicated for perforation pattern indicated].
7. Pan Width: 8-inch module width and 7-1/43/8-inch face width .
8. Metal-Pan Finish: Protected on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping and as follows:

    a. Laminated-Film Finish: Provide PVC-free film permanently bonded to metal pan with adhesive.

1) Color and Pattern: As indicated in Material Selection Schedule..

b. Finish Bonding Adhesive: Manufacturer's standard that permanently bonds finish to aluminum.

9. Pan Splices: Formed for snap fit into butt-cut pans, Manufacturer's standard length .

a. Finish: Matching pan.

10. End Caps: Manufacturer's standard material fabricated to fit and conceal exposed ends of pans.

a. Finish: Matching pan.

11. Suspension-System Main-Carrier Material: Manufacturer's standard material and protective finish.

2.4 CARRIER-SYSTEM HANGERS, BRACES, AND TIES

A. Attachment Devices: Size for 5 times the design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated.

1. Cast-in-Place and Postinstalled Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to [**5**] <**Insert safety factor**> times that imposed by ceiling construction as determined by testing in accordance with ASTM E488/E488M or ASTM E1512, as applicable, conducted by a qualified testing and inspecting agency.

a. Type: [**Cast-in-place**] [**Postinstalled expansion**] [**Postinstalled bonded**] anchors.
b. Corrosion Protection:

1) Carbon-steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5 (0.005 mm) for Class SC service condition (mild).
2) Stainless steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.
3) Components fabricated from nickel-copper-alloy rods complying with ASTM B164 for UNS No. N04400 alloy.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to [**10**] <**Insert safety factor**> times that imposed by ceiling construction as determined by testing in accordance with ASTM E1190 conducted by a qualified testing and inspecting agency.

B. Wire Hangers, Braces, and Ties: Provide wire complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Stainless Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
3. Nickel-Copper-Alloy Wire: ASTM B164, nickel-copper-alloy UNS No. N04400.
4. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C635/C635M, Table 1, Direct Hung is less than yield stress of wire, but provides not less than [**0.106-inch-**] [**0.135-inch-**] <**Insert dimension**> diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed from 0.04-inch- thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

F. Exterior Bracing: Cold-rolled steel channels and angles, hot-dip galvanized to comply with ASTM A653/A653M, G60 coating designation; size and profile as required to withstand wind load.

2.5 ACCESSORIES

A. Access Panels: For access at locations indicated, provide door hinge assembly, retainer clip, and retainer bar, assembled with ceiling panels and carrier sections into access doors permitting upward or downward opening.

1. Size: As indicated on Drawings.

B. Air-Distribution Devices: Where indicated on Drawings, provide independently suspended air-distribution devices that are relocatable and adjustable from below finished ceiling, that do not interrupt ceiling components, and that are fully concealed by and integrated with ceiling system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Measure each ceiling area and establish layout of linear metal pans.

1. Balance border widths at opposite edges of each ceiling.
2. Avoid using less-than-half-width pans at borders.

B. Comply with ASTM C636/C636M and seismic requirement indicated, in accordance with manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

C. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns in 3 inches. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate to which hangers are attached and for type of hanger involved.

5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that does not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, power-actuated fasteners, or postinstalled mechanical or adhesive anchors that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

D. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns in 1-1/2 inches. Suspend bracing from building's structural members as required for hangers and without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

E. Install edge moldings and trim at perimeter of linear metal ceiling area and where necessary to conceal edges and ends of linear metal pans.

1. Screw attach moldings to substrate at intervals of not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

F. Install suspension-system carriers so they are aligned and securely interlocked with one another.

1. Install stabilizer channels, tees, and bars at regular intervals to stabilize carriers and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated.
2. Remove and replace dented, bent, or kinked members.

G. Cut linear metal pans for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness.

H. Install linear metal pans in coordination with suspension system and exposed moldings and trim.

1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated on Drawings.
2. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.

    a. Install pans with butt joints aligned using internal pan splices.

3. Install directionally textured or patterned metal pans in directions indicated.
4. Where metal pan ends are visible, install end caps unless trim is indicated.

5. Install sound-absorbent pads at right angle to perforated metal pans so pads do not hang unsupported.

I. Install hold-down clips where indicated.

3.2 CLEANING

A. Clean exposed surfaces of linear metal ceilings, including trim and edge moldings, after removing strippable, temporary protective covering if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 09 5423

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SECTION 09 6466 - WOOD ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes wood athletic flooring.

1.2 COORDINATION

A. Coordinate layout and installation of slab depressions to accommodate layout and height of wood athletic flooring assembly.

B. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of floor assembly, include the following:

1. Plans, sections, and attachment details.
2. Details of concrete-slab depressions.
3. Expansion provisions and trim details.
4. Layout, colors, widths, and dimensions of game lines and markers.
5. Locations of floor inserts for athletic equipment installed through flooring assembly.

C. Samples for Initial Selection: For each type of wood athletic flooring and accessory in each type of exposed color and finish.

1. Include manufacturer's color charts showing colors and glosses available for the following:
   a. Floor finishes.
   b. Game-line and marker paints.

D. Samples for Verification: For each type of wood athletic flooring and accessory required; approximately 12 inches long and of same thickness and material indicated for the Work.

1. Include Sample sets showing the full range of normal color and texture variations expected in wood flooring.
2. Include Sample sets showing finishes and game-line and marker paints applied to wood flooring.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced Installer who has completed wood athletic flooring installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in installations with a record of successful in-service performance.

1. Installer responsibilities include installation and field finishing of wood athletic flooring components and accessories, and application of game lines and markers.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver floor assembly materials in unopened cartons or bundles.

B. Protect wood from exposure to moisture. Do not deliver wood components until after concrete, masonry, plaster, ceramic tile, and similar wet-work is complete and dry.

C. Store wood components in a dry, warm, well-ventilated, weathertight location and in a horizontal position.

1.8 FIELD CONDITIONS

A. Conditioning period begins not less than seven days before wood athletic flooring installation, is continuous through installation, and continues not less than seven days after installation.

1. Environmental Conditioning: Maintain ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants, but not less than 35 percent or more than 50 percent, in spaces to receive wood athletic flooring during the conditioning period.
2. Wood Conditioning: Move wood components into spaces where they will be installed, no later than beginning of the conditioning period.
    a. Do not install wood athletic flooring until wood components adjust to relative humidity of, and are at same temperature as, spaces where they are to be installed.
    b. Open sealed packages to allow wood components to acclimatize immediately on moving wood components into spaces in which they will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Install wood athletic flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide wood athletic flooring systems tested by a qualified testing agency according to DIN V 18032-2 and shown to meet the following requirements:

1. Shock Absorption: Minimum 53 percent.
2. Vertical Deflection: Minimum 0.09 inch.
3. Area of Deflection: Maximum 15 percent.
4. Ball Bounce: Minimum percent.
5. Surface Friction: Not less than 0.5 or more than 0.7.
6. Rolling Loads: No damage when subjected to 337 lbf applied through a single wheel.

B. Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.

1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.

2.2 WOOD ATHLETIC FLOORING

A. Products: Subject to compliance with requirements, provide products as indicated on Drawings.

2.3 WOOD ATHLETIC FLOORING

A. Wood Athletic Flooring: Floating athletic flooring system.
   a. Products: Basis of Design: Tarkett Sports Indoor; Clutch Court, Trainer 3

2. Subject to compliance with requirements, provide one of the following:
   a. Aacer Flooring, LLC..
   b. Action Floor Systems, LLC.
   c. Conner Sports Surface Solutions.
   d. Robbins Sports Surfaces.

3. Overall System Height: 2-1/2 inches.
4. Random-Length Strip Flooring: Northern hard maple (Acer saccharum), kiln dried, random length, tongue and groove, and end matched.
   a. Grade: MFMA-RL Third and Better on the surrounding areas.
   b. Cut: Edge.
   c. Lengths: Nominal 15 to 96 inches complying with MFMA grading rules, unless otherwise required for patterns indicated.
   d. Thickness: 25/32 inch.
   e. Face Width: 2-1/4 inches.

2.4 SUBFLOOR MATERIALS

A. Board Underlayment: Nominal 1-by-6-inch graded boards; of SPIB No. 2 Southern pine, WCLIB Construction grade (any species), or WWPA No. 3 (any species), dried to 15 percent moisture content.

B. Plywood Underlayment: APA rated, C-D plugged, exterior glue, tongue and groove, in manufacturer's standard thicknesses for flooring assembly. .

C. Wood Sleepers: Standard grade; 48 inches long; kiln-dried Eastern hemlock, fir, pine, or spruce.

1. Size: As standard with manufacture for indicated assembly.
2. Sleeper Anchors: Manufacturer's standard drive pins recommended by anchor manufacturer to achieve minimum 900-lbf pullout strength in 3000-psi concrete.
3. Sleeper Shims: In size and type recommended in writing by flooring manufacturer for application indicated.

D. Channels: Manufacturer's standard as indicated by product designation above.

1. Channel Anchors: Manufacturer's standard, but not less than modified steel drive pins recommended by anchor manufacturer to achieve minimum 900-lbf pullout strength.

E. Resilient Pads: With air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated above.

1. Type: Rectangular or conical.
2. Material: Manufacturer's standard Rubber or Neoprene.
3. Thickness: As standard for flooring assembly.

2.5 FINISHES

A. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer, and MFMA approved.

1. Floor-Sealer Formulation: Pliable, penetrating type. MFMA Group 1, Sealers.
2. Finish-Coat Formulation: Formulated for gloss finish indicated and multicoat application.
   a. Type: MFMA Group 3, Gymnasium-Type Surface Finishes.

3. Game-Line and Marker Paint: Industrial enamel compatible with finish coats and recommended in writing by manufacturers of finish coats, and paint for this use.

2.6 ACCESSORIES

A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6 mils thick.

B. Resilient Wall Base: Molded, vented, rubber or vinyl cove base; 4 by 3 by 48 inches; with premolded outside corners.

1. Color: Black.

C. Thresholds: Aluminum, 1/8 inch thick with beveled edges and clear anodized finish

D. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood athletic flooring manufacturer.

E. Adhesives: Manufacturer's standard for application indicated.

1. VOC Content: 100 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Concrete Slabs:

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
   a. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
   b. Perform additional moisture tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. Concrete Slabs:

1. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

B. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Comply with wood athletic flooring manufacturer's written instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.

B. Pattern: Lay flooring parallel with long dimension of space to be floored unless otherwise indicated.

C. Expansion Spaces: Provide as indicated, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.

1. Cover expansion spaces with base molding, trim, and saddles, as indicated on Drawings.
2. Install thresholds at all flooring edges not adjacent to walls.

D. Blocking: Provide blocking under flooring in areas indicated as follows:

1. Under Bleachers in Closed Position: Solid blocking to allow no deflection of flooring.
2. Under Bleachers in Open Position: Partial blocking between all supports in thickness as required to allow a minimum deflection of 1/8 inch and limit maximum deflection of surface flooring to 1/4 inch.

E. Vapor Retarder: Cover entire slab area beneath wood flooring. Install with joints lapped a minimum of 6 inches and sealed.

F. Underlayment: Install with top layer in orientation to direction of flooring as recommended by manufacturer, staggering end joints in adjacent rows.

1. Place underlayment on resilient pads spaced in accordance with manufacturer’s instructions.

G. Installation Tolerances: 1/8 inch in 10 feet of variance from level.

3.4 SANDING AND FINISHING

A. Allow installed flooring to acclimate to ambient conditions before sanding.

B. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors."

C. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups. Remove sanding dust by tack or vacuum.

D. Finish: Apply seal and finish coats of finish system according to finish manufacturer's written instructions. Provide no fewer than four coats total and no fewer than two finish coats.

E. Protect wood athletic flooring during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.

1. Do not cover flooring after finishing until finish reaches full cure and not before seven days after applying last finish coat.
2. Do not move heavy and sharp objects directly over flooring. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 6466

SECTION 09 6500 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient sheet flooring.
2. Resilient tile flooring.

B. Related Sections:

1. Section 09 6513 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.
2. Section 09 6566 "Resilient Athletic Flooring" for resilient floor coverings for use in athletic-activity or support areas.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient sheet flooring.

1. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Verification: For each type of resilient flooring, in manufacturer's standard size, but not less than 6-by-9-inch sections of each color, texture, and pattern required.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Sheet Flooring (RSF-1 Only): Furnish 1 roll.
2. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient flooring installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1. Store rolls upright.
2. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient flooring during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during resilient flooring installation.

D. Close spaces to traffic for 48 hours after resilient flooring installation.

E. Install resilient flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 RESILIENT FLOORING

A. Products: Subject to compliance with requirements, provide products indicated on Drawings.

2.3 RESILIENT SHEET FLOORING

A. Sheet Vinyl Flooring (RSF-1): As follows:

1. Product: Subject to compliance with requirements, provide Polyflor; Pearlazzo.
   a. Color: .As indicated in Material Selection Schedule

2. Unbacked Vinyl Sheet Flooring: ASTM F 1913.
   a. Thickness: 0.080 inch.

3. Wearing Surface: Smooth.
4. Sheet Width: 6.6 feet.
5. Seamless-Installation Method: Heat welded.

B. Sheet Vinyl Flooring (RSF-2): As follows:

1. Product: Subject to compliance with requirements, provide Oscoda Plastics, Inc.; Protect-All.
   a. Color: As indicated in Material Selection Schedule

2. Unbacked Vinyl Sheet Flooring: ASTM F 1913.
   a. Thickness: 1/4 inch (6mm).

3. Wearing Surface: Smooth.
4. Sheet Width: 5 feet x 8 feet (1.5 m x 2.5 m).
5. Seamless-Installation Method: Chemically bonded.

C. Sheet Vinyl Flooring (RSF-3): As follows:

1. Product: Subject to compliance with requirements, provide C.I. Takiron; Nattice.
   a. Color: As indicated in Material Selection Schedule

2. Unbacked Vinyl Sheet Flooring: ASTM F 1913.
   a. Thickness: 0.10 inch (2.5mm).

3. Wearing Surface: Embossed.
4. Sheet Width: 6 feet.

5. Seamless-Installation Method: Heat welded.

2.4 RESILIENT TILE

A. Luxury Vinyl Floor Tile (LVT-1): As follows:

1. Product: Subject to compliance with requirements, provide Interface; Natural Woodgrains.
   a. Color: As indicated in Material Selection Schedule.

2. Tile Standard: ASTM F 1700.
   a. Class: Class III, Printed Film Vinyl Tile.

3. Thickness:.
4. Size: 9.845 inches x 39.38 inches (25 cm x 1 m).

B. Luxury Vinyl Floor Tile (LVT-2): As follows:

1. Product: Subject to compliance with requirements, provide Shaw Contract; Type.
   a. Color: As indicated in Material Selection Schedule.

2. Tile Standard: ASTM F 1700.
   a. Class: Class III, Printed Film Vinyl Tile.
   b. Type: B, Embossed Surface.

3. Thickness: 0.197 inch (5 mm).
4. Size: 24 by 24 inches.

C. Luxury Vinyl Floor Tile (LVT-3): As follows:

1. Product: Subject to compliance with requirements, provide Shaw Contract; Coded.
   a. Color: As indicated in Material Selection Schedule.

2. Tile Standard: ASTM F 1700.
   a. Class: Class III, Printed Film Vinyl Tile.
   b. Type: B, Embossed Surface.

3. Thickness: 0.197 inch (5 mm).
4. Size: 6 inches x 48 inches (15.cm x 122 cm).

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

C. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch radius provided or approved by resilient sheet flooring manufacturer.
2. Cap Strip: Z-Bar profile provided by or approved by resilient sheet flooring manufacturer.
3. Corners: Metal inside and outside corners and end stops provided or approved by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to resilient flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient flooring until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient flooring.

3.2 RESILIENT FLOORING INSTALLATION

A. General: Comply with manufacturer's written instructions for installing resilient flooring.

1. Scribe and cut resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
2. Extend resilient flooring into toe spaces, door reveals, closets, and similar openings.
3. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient flooring as marked on substrates. Use chalk or other nonpermanent marking device.

4. Install resilient flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.
5. Adhere resilient flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
6. Seamless Installation:
    a. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
    b. Chemically Bonded Seams: Bond seams with chemical-bonding compound to fuse sections permanently into a seamless flooring installation. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.

B. Resilient Sheet Flooring: Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

1. Lay out resilient sheet flooring as follows:
    a. Maintain uniformity of flooring direction.
    b. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
    c. Match edges of flooring for color shading at seams.
    d. Avoid cross seams.

2. Integral-Flash-Cove Base: Cove resilient sheet flooring to dimension indicated within Material Selection Schedule up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.
    a. Install metal corners at inside and outside corners.

C. Resilient Tile: Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated on finish plans.
2. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient flooring.

B. Perform the following operations immediately after completing resilient flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Cover resilient flooring until Substantial Completion.

END OF SECTION 09 6500

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SECTION 09 6513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoplastic-rubber base.
2. Resilient stair accessories.
3. Rubber stair accessories.
4. Resilient molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 5 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE AND ACCESSORIES

A. Products: Subject to compliance with requirements, provide products indicated on Drawings.

2.2 RESILIENT BASE

A. Thermoplastic-Rubber Base (RB-1): ASTM F 1861, Type TP (rubber, thermoplastic).

1. Product: Subject to compliance with requirements, provide Tarkett / Johnsonite; Duracove.
   a. Color: As specified within Material Selection Schedule.

2. Group: I (solid, homogeneous).
3. Style: Style B, cove.
4. Thickness: 0.125 inch.
5. Height: 4 inches.
6. Lengths: Coils in manufacturer's standard length.
7. Outside Corners: Job formed.
8. Inside Corners: Job formed.

B. Thermoplastic-Rubber Base (RB-2): ASTM F 1861, Type TP (rubber, thermoplastic).

1. Product: Subject to compliance with requirements, provideTarkett / Johnsonite ;Millwork
   a. Color: As indicated within Material Selection Schedule.

2. Group: I (solid, homogeneous).
3. Style and Location:
   a. Style D, Sculptured: Provide in areas indicated on finish plans.
      1) Profile: Monument.

4. Thickness: 0.25 inch (6.4 mm).
5. Height: 4 inches.
6. Lengths: Coils in manufacturer's standard length.
7. Outside Corners: Job formed.
8. Inside Corners: Job formed.

C. Thermoplastic-Rubber Base (RB-3): ASTM F 1861, Type TP (rubber, thermoplastic).

1. Product: Subject to compliance with requirements, provide Tarkett / Johnsonite; Duracove
   a. Color: As indicated within Material Selection Schedule.

2. Group: I (solid, homogeneous).
3. Style: Style B, cove.
4. Thickness: 0.125 inch.
5. Height: 2-1/2 inches.
6. Lengths: Coils in manufacturer's standard length.
7. Outside Corners: Job formed.
8. Inside Corners: Job formed.

D. Thermoplastic-Rubber Base (RB-4): ASTM F 1861, Type TP (rubber, thermoplastic).

1. Product: Subject to compliance with requirements, provide Tarkett / Johnsonite; Millwork
   a. Color: As indicated within Material Selection Schedule.

2. Group: I (solid, homogeneous).
3. Style and Location:
   a. Style D, Sculptured: Provide in areas indicated on finish plans.
      1) Profile: Mandalay.

4. Thickness: 0.375 inch.
5. Height: 6 inches.
6. Lengths: Coils in manufacturer's standard length.
7. Outside Corners: Job formed.
8. Inside Corners: Job formed.

2.3 VINYL STAIR ACCESSORIES

A. Stair Treads (RST-1): ASTM F 2169.

1. Product: Subject to compliance with requirements, provide C.I Takiron; Nattice
   a. Color: As indicated within Material Selection Schedule .

2. Type: TV (vinyl, thermoplastic).
3. Class: 2 (pattern; embossed, grooved, or ribbed).
4. Group: 2 (with contrasting color for the visually impaired).
5. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
6. Nosing Height: 1.57 inches (40 mm).
7. Thickness: 0.10 inch (2.5mm).
8. Size: Lengths and depths to fit each stair tread in one piece.

B. Integral Risers: Smooth, flat; in height that fully covers substrate.

2.4 RUBBER MOLDING ACCESSORY

A. Description: Rubber nosing for carpet.

B. Profile and Dimensions: As indicated on Drawings.

C. Locations: Provide rubber molding accessories in areas indicated.

D. Colors: Match adjacent rubber base.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
   a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
   a. Miter or cope corners to minimize open joints.

3.3 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 6513

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SECTION 09 6566 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet vinyl flooring.

B. Related Requirements:

1. Section 09 6513 "Resilient Base and Accessories" for wall base and accessories installed with resilient athletic flooring.

1.2 COORDINATION

A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details and locations of the following:

1. Border tiles.
2. Floor patterns.
3. Layout, colors, widths, and dimensions of game lines and markers.
4. Locations of floor inserts for athletic equipment installed through flooring.
5. Seam locations for sheet flooring.

C. Samples for Verification: For each type, color, and pattern of flooring specified, 6-inch- square in size and of same thickness and material indicated for the Work.

1. Game-Line- and Marker-Paint Samples: Include Sample sets showing game-line- and marker-paint colors applied to flooring.
2. Seam Samples: For each vinyl sheet flooring color and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.
3. Seam Samples: For each vinyl sheet flooring color and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For sheet vinyl flooring Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Sheet Vinyl Flooring Installer Qualifications: An experienced installer who has completed sheet vinyl flooring installations using seaming methods indicated for this Project and similar in material, design, and extent to that indicated for this Project; who is acceptable to manufacturer; and whose work has resulted in installations with a record of successful in-service performance.

1.7 FIELD CONDITIONS

A. Adhesively Applied Products:

1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
3. Close spaces to traffic during flooring installation.
4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.

B. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. FloorScore Certification: Resilient athletic flooring shall be certified under the RFCI FloorScore program.

B. Low-Emitting Materials: Flooring system elements shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 RESILIENT ATHLETIC FLOORING

A. Products: Subject to compliance with requirements, provide products indicated on Drawings.

2.3 SHEET FLOORING

A. Sheet Vinyl Flooring (RAF-1): Sheet vinyl flooring specifically designed for adhered athletic flooring applications.

1. Products: Subject to compliance with requirements, provide products indicated on Drawings.
2. Color and Pattern: As indicated on Material Selection Schedule and finish plans.
3. Sheet Vinyl Flooring with Backing: ASTM F 2772 Class 3.
    a. Wearlayer: 100 percent pure vinyl.
    b. Wearlayer Thickness: 0.08 inch (2.1 mm).
    c. Overall Thickness: 0.30 inch (7.5 mm).
    d. Interlayer Material: Foamed plastic.
4. Seaming Method: Heat welded.
5. Traffic-Surface Texture: Embossed.
6. Applied Finish: Triple Action Protecsol.
7. Roll Size: 4 feet 11 inches (1499 mm) wide by longest length that is practical to minimize splicing during installation.

2.4 ACCESSORIES

A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

B. Trowel-Applied Underlayment: Portland cement-based matrix formulated for skim-coating flooring substrates.

1. Product: Ardex SD-F Feather Finish.

C. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.

1. VOC Content: Not more than 60 g/L.

D. Game-Line and Marker Paint: Complete system including primer, if any, compatible with flooring and recommended in writing by flooring and paint manufacturers for use indicated.

1. VOC Content: Not more than 150 g/L.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.
3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Provide trowel-applied underlayment over all slabs to receive adhered flooring where existing flooring is removed.

F. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FLOORING INSTALLATION

A. General: Comply with manufacturer's written installation instructions.

1. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
2. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
3. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

B. Sheet Flooring Installation: Unroll sheet flooring and allow it to stabilize before cutting and fitting.

1. Lay out sheet flooring as follows:
   a. Maintain uniformity of flooring direction.
   b. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
   c. Match edges of flooring for color shading at seams.
   d. Locate seams according to approved Shop Drawings.

2. Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
   a. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3. Vinyl Sheet Flooring Seams: Prepare and finish seams to produce surfaces flush with adjoining flooring surfaces.
   a. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless flooring.

3.3 GAME LINES AND MARKERS

A. Mask flooring at game lines and markers, and apply paint to produce sharp edges. Where crossing, break minor game line at intersection; do not overlap lines.

B. Apply game lines and markers in widths and colors according to requirements indicated on Drawings.

3.4 FIELD-APPLIED FINISHES

A. Apply finish after game-line and marker paint is fully cured.

B. Apply finish according to manufacturer's written instructions to produce a sealed surface that is ready for use.

C. Do not cover flooring after finishing until finish reaches full cure.

3.5 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing flooring installation:

1. Remove adhesive and other blemishes from flooring surfaces.
2. Sweep and vacuum flooring thoroughly.
3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.

B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 6566

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SECTION 09 6813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modular carpet tile.

B. Related Requirements:

1. Section 09 6513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
2. Section 09 6816 "Sheet Carpeting" for carpet roll goods.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.

1.8 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:
    a. More than 10 percent edge raveling, snags, and runs.
    b. Dimensional instability.
    c. Excess static discharge.
    d. Loss of tuft-bind strength.
    e. Loss of face fiber.
    f. Delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Products: Subject to compliance with requirements, provide products indicated on Drawings.

1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.

2.2 CARPET TILE

A. Carpet TileCPTL-1 : As follows:

1. Product: Subject to compliance with the requirements, provide J+J Flooring; Forces of Nature Collection, Cumulus Pattern
    a. CPTL-1: As Indicated on Material Selection Schedule.

2. Fiber Type: Encore SD Ultima (with recycled content).
3. Pile Characteristic:Patterned Loop pile.
4. Surface Pile Weight: 22 oz./sq. yd..
5. Backing System: Nexus Modular.
6. Size: 18 by 36 inches.
7. Performance Characteristics:
    a. Electrostatic Propensity: Less than 3 kV according to AATCC 134.

B. Carpet TileCPTL-2, -4, -6: As follows:

1. Product: Subject to compliance with the requirements, provide Interface; Open Air 404 Accent
    a. CPTL-2: As indicated on Material Selection Schedule.
    b. CPTL-4: As indicated on Material Selection Schedule.
    c. CPTL-6: As indicated on Material Selection Schedule.

2. Fiber Type: Aquafil, 100% Recycled Content Nylon.
3. Pile Characteristic: Tufted Textured Loop pile.
4. Surface Pile Weight: 19 oz./sq. yd..
5. Backing System: GlasBac.
6. Size: 19.69 x 19.69 in (50 x 50 cm).
7. Applied Treatments:
    a. Soil-Resistance Treatment: Protekt2.
    b. Antimicrobial Treatment: Intersept that protects carpet tiles as follows:
        1) Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

8. Performance Characteristics:
    a. Electrostatic Propensity: Less than 3 kV according to AATCC 134.

C. Carpet Tile CPTL-3, -5, -7-As follows:

1. Product: Subject to compliance with the requirements, provide Interface; Open Air 404 Transition.
    a. CPTL-3: As noted within Material Selection Schedule.
    b. CPTL-5: As noted within Material Selection Schedule.
    c. CPTL-7: As noted within Material Selection Schedule.

2. Fiber Type: Aquafil, 100% Recycled Content Nylon.
3. Pile Characteristic: Tufted Textured Loop pile.
4. Surface Pile Weight: 19 oz./sq. yd..
5. Backing System: GlasBac.
6. Size: 19.69 x 19.69 in (50 x 50 cm).
7. Applied Treatments:
    a. Soil-Resistance Treatment: Protekt2.
    b. Antimicrobial Treatment: Intersept that protects carpet tiles as follows:
        1) Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

8. Performance Characteristics:
    a. Electrostatic Propensity: Less than 3 kV according to AATCC 134.

D. Carpet Tile CPTL-8As follows:

1. Product: Subject to compliance with the requirements, provide Interface; Open Air 404.
   a. CPTL-8: As noted on Material Selection Schedule.

2. Fiber Type: Aquafil, 100% Recycled Content Nylon.
3. Pile Characteristic: Tufted Textured Loop pile.
4. Surface Pile Weight: 19 oz./sq. yd..
5. Backing System: GlasBac.
6. Size: 19.69 x 19.69 inches (50 x 50 cm).
7. Applied Treatments:
   a. Soil-Resistance Treatment: Protekt2.
   b. Antimicrobial Treatment: Intersept that protects carpet tiles as follows:
      1) Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

8. Performance Characteristics:
   a. Electrostatic Propensity: Less than 3 kV according to AATCC 134.

E. Carpet Tile CPTL-9As follows:

1. Product: Subject to compliance with the requirements, provide Milliken; Lyceum Collection, Plato Trimline pattern
   a. CPTL-9: As indicated within Material Selection Schedule.

2. Fiber Type: Milliken-Certified WearOn Nylon.
3. Pile Characteristic: Tufted Textured Loop pile.
4. Total Weight: 104 oz./sq. yd. for finished carpet tile.
5. Backing System: PVC-Free WellBAC Comfort Plus Cushion.
6. Size: 39.4 x 39.4 inches (1 x 1 m).
7. Applied Treatments:
   a. Soil-Resistance Treatment: StainSmart.

8. Performance Characteristics:
   a. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

F. Carpet Tile CPTL-10 As follows:

1. Product: Subject to compliance with the requirements, provide Custom printed carpet tile from Milliken; Lyceum collection, Plato Trimline pattern. .
   a. CPTL-10: As indicated within Material Selection Schedule.

2. Fiber Type: Milliken-Certified WearOn Nylon.
3. Pile Characteristic: Tufted Textured Loop pile.
4. Total Weight: 104 oz./sq. yd. for finished carpet tile.
5. Backing System: PVC-Free WellBAC Comfort Plus Cushion .
6. Size:39.4 x 39.4 inches (1 x 1 m).
7. Custom graphic print factory-applied to face of carpet using Manufacturer's ink jet method.
8. Applied Treatments:
   a. Soil-Resistance Treatment:StainSmart.

9. Performance Characteristics:
    a. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

G. Carpet TileECPTL-1: As follows:

1. Product: Subject to compliance with the requirements, provide Milliken; Obex Entrance Flooring collection, Cut/Strum style.
    a. ECPTL-1: As indicated within Material Selection Schedule.

2. Fiber Type: Milliken-Certified WearOn Nylon Monofilament.
3. Pile Characteristic: Tufted Cut pile.
4. Total Weight: 130 oz./sq. yd. for finished carpet tile.
5. Backing System: PVC-Free WellBAC Comfort Plus Cushion.
6. Size: 19.7 x 19.7 inches (50 x 50 cm).
7. Performance Characteristics:
    a. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

H. Textile Composite FlooringTCF-1: As follows:

1. Product: Subject to compliance with the requirements, provide J+J Flooring; Kinetex, Downtown style.
    a. TCF-1: As noted within Material Selection Schedule.

2. Fiber Type: Abrasion and Ravel Resistant Knitted Fabric.
3. Pile Characteristic: textile composite.
4. Total Weight: 4.5 – 5.2 oz./sq. yd. for finished carpet tile.
5. Backing System: Polyester Felt Cushion with PreFix Adhesive.
6. Size: 24 by 24 inches.
7. Performance Characteristics:
    a. Electrostatic Propensity: Less than 3 kV according to AATCC 134.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Trowel-Applied Underlayment: Portland cement-based matrix formulated for skim-coating flooring substrates.

1. Product: Ardex SD-F Feather Finish.

C. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

1. VOC Content: 50 g/L or less.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

1. Concrete Slabs:
   a. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      1) Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
      2) Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
2. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
3. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.2 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

1. Provide J&J's PreFix pre-applied adhesive on Textile Composite Flooring (TCF-1).

C. Installation Pattern: As indicated on Drawings and/or within Material Selection Schedule.

D. Maintain dye-lot integrity. Do not mix dye lots in same area.

E. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.

F. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

G. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

H. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

I. Install pattern parallel to walls and borders.

J. Cleaning: Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

K. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

L. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 6813

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SECTION 09 7200 - WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl wall covering.
2. Textile wall covering.
3. Heavy-duty, synthetic-textile wall covering.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams, and termination points.

C. Samples for Verification: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36 inches long in size.

D. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for installation.

1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F1141 for appearance shading characteristics.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates in accordance with test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: Insert value or less.

2. Fire-Growth Contribution: No flashover and heat and smoke release when tested in accordance with NFPA 265.

2.2 WALL COVERINGS

A. Products: Subject to compliance with requirements, provide products indicated on Drawings.

2.3 VINYL WALL COVERING

A. Impact Resistant Vinyl Wall Covering (IRWC-1):

1. Product: Subject to compliance with requirements, provide Wolf Gordon; Rampart collection, Grain style. Color as indicated within Material Selection Schedule:

2. Description: Provide vinyl products in rolls from same production run and complying with the following:
   a. Wallcovering Association's W-101 for Type III, Heavy Duty.

3. Total Weight: 35 oz/ linear yard, excluding coatings.
4. Width: 52 inches (1320.8 mm).
5. Backing: Drill fabric.
   a. Fiber Content: Cotton.

6. Features:
   a. Stain-Resistant Coating: Surcoat stain- and abrasion- resistant treatment.
   b. Water-based inks.

B. Vinyl Wall Covering (VWC-1):

1. Description: Provide vinyl products in rolls from same production run and complying with the following:
   a. Wallcovering Association's W-101 for Type II, Medium Duty.

2. Total Weight: 20 oz/ly (620 gr/lm), excluding coatings.
3. Width: 52 inches (132 cm).
4. Backing: Osnaburg fabric.

a. Fiber Content: Polyester cellulose.

5. Repeat: 18 inches V, 25 inches H (46 cm V, 132 cm H).
6. Features:
   a. Phthalate free.
   b. Heavy-metals free.

2.4 TEXTILE WALL COVERING

A. Acoustic Wall Covering (AWC-1, -2, -3, -4):

1. Product: Subject to compliance with requirements, provide Autex; Vertiface. Colors as indicated on Material Selection Schedule:
2. Test Responses:
   a. Colorfastness to Light: ISO 105-B02:2014 Rating: 6.
   b. Mildew Resistance: Rating of zero or 1 when tested in accordance with ASTM G21.
3. Total Weight:1.25 oz/sq. ft., excluding coatings.
4. Width: 51 inches.
5. Repeat: Non-woven. No pattern repeat, but product has directional grain.
6. Applied Backing Material: None.
7. Features:
   a. Tackable.
   b. Antimicrobial.
   c. PVC free.
   d. Phthalate free.
   e. Heavy-metals free.
   f. Halogenated-fire-retardant free.
   g. Hook and loop combatible.

2.5 HEAVY-DUTY, SYNTHETIC-TEXTILE WALL COVERING

A. Impact Resistant Wall Covering (IRWC-2, -3, -4, -5):

1. Product: Subject to compliance with requirements, provide Momentum Textiles & Wall Covering; Vantage III Collection, Verdon style. Colors as indicated within Material Selection Schedule.
2. Description: Provide wall coverings in rolls from same production run and that comply with the following:
   a. Wallcoverings Association's W-101: Type III, Heavy Duty (Polyolefin Coated).
3. Total Weight: 33 oz / lf.
4. Width: 54 inches.
5. Applied Backing Material: Drill.
6. Features:
   a. Stain-Resistant: ASTM D1308:10.
   b. Water-based inks.
   c. PVC free.
   d. Phthalate free.

B. Woven Wall Covering (WWC-1, -2, -3, -4):

1. Product: Subject to compliance with requirements, provide Maharam; Tek-Wall Cameo. Colors as indicated on Material Selection Schedule.
2. Description: Provide wall coverings in rolls from same production run and that comply with the following:
   a. Wallcoverings Association's W-101: Type III, Heavy Duty (Polyolefin Coated).
3. Test Responses:
   a. Colorfastness to Light: Complies with AATCC 16E, 80+ hours.
4. Total Weight: 12.3 oz / ly (400 gr / lm).
5. Width: 56 inches (142 cm).
6. Applied Backing Material: Acrylic.
7. Features:
   a. Stain-Resistant Coating

2.6 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.

1. VOC Content: 50 g/L or less.

B. Primer/Sealer: Mildew resistant, complying with requirements in Section 09 9123 "Interior Painting" and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

C. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation surfaces being true in plane and vertical and horizontal alignment, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, and mildew.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Plaster: Allow plaster to cure for at least 90 days. Neutralize areas of high alkalinity. Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
3. Metals: If not factory primed, clean and apply metal primer as recommended in writing by metal-primer manufacturer and wall-covering manufacturer.
4. Gypsum Board: Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
5. Painted Surfaces:
    a. Check for pigment bleeding. Apply primer/sealer to areas susceptible to pigment bleeding as recommended in writing by primer/sealer manufacturer.
    b. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.

D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION OF WALL COVERING

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip.

D. Install wall covering without lifted or curling edges and without visible shrinkage.

E. Match pattern 72 inches above the finish floor.

F. Install seams vertical and plumb at least 6 inches from outside corners and 6 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.

G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 7200

SECTION 09 7723 - FABRIC-WRAPPED PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shop-fabricated, fabric-wrapped wall panels.

B. Related Sections:

1. Section 06 2023 “Interior Finish Carpentry” for wall panel assemblies mounted to cubbies.
2. Section 09 7200 "Wall Coverings" for adhesively applied textile wall coverings and for coordinated requirements for fabric.
3. Section 09 8433 "Sound-Absorbing Wall Units" for shop-fabricated, acoustical wall panels tested for acoustical performance and for coordinated requirements for fabric.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel assembly and installation.

C. Samples for Verification: For the following products:

1. Fabric: Full-width by approximately 12-inch- long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not install panels until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Air-Quality Limitations: Protect panels from exposure to airborne odors such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Panels shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.2 FABRIC-WRAPPED PANELS

A. Products: Subject to compliance with requirements, provide products indicated on Drawings.

2.3 FABRIC-WRAPPED WALL PANELS

A. Fabric-Wrapped Wall Panel (FWP-1): 3/4”-thick plywood panel consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.

1. Mounting: Edge mounted with splines secured to substrate.
2. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
3. Core: 3/4”-thick plywood.
4. Edge Profile: Custom profile as indicated on Drawings.
5. Corner Detail in Elevation: Square with continuous edge profile indicated.
6. Reveals between Panels: Flush reveals as indicated on Drawings.
7. Facing Material (FWP-1): Fabric from same dye lot; color and pattern as indicated in Material Selection Schedule..
8. Nominal Core Thickness: 3/4 inch.
9. Panel Width: As indicated on Drawings.
10. Panel Height: As indicated on Drawings.

2.4 MATERIALS

A. Core Materials: Manufacturer's standard.

1. Wood and Plywood: Manufacturer's standard plywood or clear, vertical grain, straight, kiln-dried hardwood.
   a. Plywood shall comply with the testing and product requirements of the California Department of Public Health's Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.

b. Fire-retardant treated by pressure process with a flame-spread index of 25 or less when tested according to ASTM E 84 or UL 723, 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) Treated material shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/D 3201M at 92 percent relative humidity.
   2) Kiln-dry material after treatment to 19 percent for lumber and 15 percent or less for plywood.

B. Facing Material: Fabric from same dye lot; color and pattern as indicated on Drawings.

C. Mounting Devices: Concealed on back of panel, recommended by manufacturer to support weight of panel, and as follows:

1. Adhesives: As recommended by panel manufacturer and with a VOC content of 70 g/L or less.
2. Adhesives: As recommended by panel manufacturer and that comply with the testing and product requirements of the California Department of Public Health's Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.

2.5 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.

C. Facing Material : Apply fabric fully covering visible surfaces of panel; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.

1. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.

D. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panels in locations indicated. Unless otherwise indicated, install panels with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.

C. Align fabric pattern and grain with adjacent panels.

3.2 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 7723

SECTION 09 8316 - ACOUSTIC CEILING COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Spray-applied acoustic ceiling finishes

B. Related Sections:

1. Section 07 2100 "Thermal Insulation" for spray-applied thermal insulation.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Clips, hangers, supports, sleeves and other attachments to spray bases are to be placed prior to the application of sprayed insulation.

1. Do not install ducts, piping, conduit or other suspended equipment until after the application of acoustic coating.
2. Roof penetrations to be installed prior to application of acoustic coating.

1.3 ACTION SUBMITTALS

A. Product data.

1.4 INFORMATIONAL SUBMITTALS

A. Quality Assurance/Control Submittals:

1. Certificates: Certifying that products comply with the requirements.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Shipping, Handling, and Unloading: Deliver in original, unopened containers bearing name of manufacturer, product identification and reference to U.L. testing.

B. Storage and Protection: Store materials dry, off ground, and under cover. Protect liquid adhesive from freezing.

PART 2 - PRODUCTS

2.1 ACOUSTIC CEILING COATINGS

A. Products: Subject to compliance with requirements, provide products indicated on Drawings.

2.2 ACOUSTIC CEILING COATINGS

A. Acoustic Ceiling Coating (ACC-#): Integrally colored spray-applied acoustic coating consisting of cellulous or glass fibers in adhesive binder containing no urea-formaldehyde resins, suitable for use as interior finish surface.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. International Cellulose Corporation; K-13.

2. Regulatory Requirements: Product shall be Class 1 Class A per ASTM E 84/ UL 723.
3. Performance Requirements:
   a. Acoustic Performance: As follows over solid backing:
      1) 2-inch Thickness: 0.95 NRC.
   b. Thermal Performance: Thermal resistivity of 3.8 deg F x h x sq. ft./Btu x in. at 75 deg F.

4. Colors: As follows:
   a. ACC-1: As indicated within Material Selection Schedule.
   b. ACC-2: As indicated within Material Selection Schedule.

2.3 ACCESSORIES

A. Primer: As recommended by manufacturer for substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and report unsatisfactory conditions in writing. Do not proceed until unsatisfactory conditions are corrected.

B. Verify surfaces to receive spray insulation to determine if priming/sealing is required to insure bonding and/or to prevent discoloration caused by migratory stains.

3.2 PREPARATION

A. Prime surfaces as required by manufacturer's instructions or as determined by examination.

3.3 INSTALLATION

A. Install in accordance with manufacturer's written instructions and recommendations in thickness as measured per ASTM E-605 field test procedure.

1. Thickness: 2 inches.

B. Where acoustic ceiling coating is applied to deck that is partially concealed by suspended ceiling below, extend acoustic ceiling coating continuously over the lower suspended ceiling.

C. Cure insulation with continuous natural or mechanical ventilation.

D. Remove and dispose of over-spray.

END OF SECTION 09 8316

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SECTION 09 8400 - TECTUM PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cementitious wood fiber plank acoustical ceiling system.

B. Related Requirements:

1. Section 09 2216 “Non-Structural Metal Framing” for ceiling suspension systems.
2. Section 09 5113 "Acoustical Panel Ceilings" for ceilings consisting of mineral-base and glass-fiber-base acoustical panels and exposed suspension systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

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

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Full-size Samples of each type, color, pattern, and texture.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.
4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical tile.
6. Items penetrating finished ceiling and ceiling-mounted items including lighting fixtures, diffusers and grilles, speakers, perimeter moldings, and access panels.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver tiles and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing tiles, permit them to reach room temperature and a stabilized moisture content.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install tectum panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain tectum panels and suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E1264.
2. Smoke-Developed Index: 450 or less.

2.3 TECTUM CEILING PANELS

A. Tectum Ceiling Panels: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

1. Product: Subject to compliance with requirements, provide the following:
   a. Armstrong World Industries: Tectum Direct-Attach
   b. As indicated on material selection schedule.

2. Surface Texture: Coarse
3. Composition: Aspen wood fibers bonded with inorganic hydraulic cement
4. Color: Natural.
5. Size: Standard 47 ¾" inches x 96 inches.
6. Thickness: Standard 1".
7. Edge Profile: Square.
8. UL Classified Noise Reduction Coefficient (NRC): ASTM C 423.
9. Dimensional Stability/Mold Resistance: HumiGuard Plus and no significant mold growth when tested by ASTM D3273.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Suspension Components for Direct Attach by Armstrong Drywall Suspension

1. Drywall Grid main beam
2. Drywall Grid cross tees
3. Perimeter Angle
4. 1-5/8" sharp point screws

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which tectum panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine tectum panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF TECTUM PANEL CEILINGS

A. Install tectum panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 ADJUSTING

A. Clean exposed surfaces of tectum panel ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace panels and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5123

SECTION 09 8433 - SOUND-ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:

1. Sound-absorbing wall panels.
2. Preserved-Moss Acoustical logo.

B. Related Requirements:

1. Section 09 7200 "Wall Coverings" for adhesively applied textile wall coverings and for coordinated requirements for fabric.
2. Section 09 7723 "Fabric-Wrapped Panels" for decorative, fabric-wrapped wall panels that are not required to be tested for acoustical performance and for coordinated requirements for fabric.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For unit assembly and installation.

C. Samples for Verification: For the following products:

1. Fabric: Full-width by approximately 36-inch- long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

C. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to the following:
    a. Acoustical performance.
    b. Fabric sagging, distorting, or releasing from panel edge.
    c. Warping of core.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Units shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.2 SOUND-ABSORBING WALL UNITS

A. Products: Subject to compliance with requirements, provide products indicated on Drawings.

2.3 SOUND-ABSORBING WALL UNITS

A. Sound-Absorbing Wall Panel (AWP-1, -2, -8, -9): Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Acoustical Panel Systems (APS, Inc.).
   b. Acoustical Solutions, Inc.
   c. Conwed Designscape; an Owens Corning company.
   d. Decoustics Limited; a Saint Gobain company.
   e. Essi Acoustical Products.
   f. Golterman & Sabo.
   g. Kinetics Noise Control; Hardside Panel (Basis of Design).

2. Panel Shape: Flat.
3. Mounting: Edge mounted with splines secured to substrate.
4. Mounting: Back mounted with manufacturer's standard impaling clips , secured to substrate.
5. Core: Glass-fiber board.
6. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
7. Edge Profile: Square .
8. Corner Detail in Elevation: Square with continuous edge profile indicated.
9. Reveals between Panels: Flush reveals as selected by Architect from manufacturer's full range .
10. Facing Material: (single source) as indicated on drawings.
11. Acoustical Performance: Sound absorption NRC of 1.0 according to ASTM C 423 for Type A mounting according to ASTM E 795.
12. Nominal Overall Panel Thickness: 2 inches.
13. Panel Width: As indicated on Drawings.
14. Panel Height: As indicated on Drawings.
15.

B. Preserved-Moss Acoustical logo (MAL-1): Manufacturer's standard aluminum frame construction filled with preserved reindeer moss.

1. Product: Subject to compliance with requirements, provide Scandinavian Spaces Nordgrona, Letters + Logos – Custom
   a. Finishes and Size: as indicated by manufacturer’s reference number on drawings.

C. Sound-Absorbing Wall Panel (AWP-3, -4, -5, -6, -7): Cementitious wood fiber sound-absorbing panel with painted surface and as follows:

1. Product: Subject to compliance with requirements, provide Armstrong Ceiling and Wall Solutions; Tectum.
2. Panel Shape: Flat.
3. Color: Custom paint color as indicated on Material Selection Schedule.
4. Mounting: C-20 Direct-Attach method.
5. Core: Cementitious-fiber board.
6. Corner Detail in Elevation: Square with continuous edge profile indicated.
7. Reveals between Panels: Flush reveals as indicated on Drawings.
8. Acoustical Performance: Sound absorption NRC of not less than .80according to ASTM C 423 for C-20 mounting according to ASTM E 795.

9. Nominal Overall Panel Thickness: 2 inches.
10. Panel Width: As indicated on Drawings.
11. Panel Height: As indicated on Drawings.

2.4 MATERIALS

A. Core Materials: Manufacturer's standard.

1. Glass-Fiber Board: ASTM C 612; of type standard with manufacturer, unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
2. Cementitious-Fiber Board: Density of not less than 20 lb/cu. ft..

B. Facing Material (AWP-1, -2, -8): Fabric from same dye lot; color and pattern as indicated on Drawings in Material Selection Schedule..

C. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:

1. Splines: Manufacturer's standard concealed metal or plastic splines that engage the kerfed edges of the unit, with other moldings and trim for interior corners, exterior corners, and exposed edges, with factory-applied finish on exposed items.
2. Adhesives: As recommended by unit manufacturer and with a VOC content of 70 g/L or less.

2.5 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Edge Hardening: For glass-fiber board cores, chemically harden core edges and areas of core where mounting devices are attached.

C. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.

D. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Align fabric pattern and grain with adjacent units.

D. Installation Tolerances:

1. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches, noncumulative.
2. Variation of Joint Width: Not more than 1/16-inch variation from reveal line in 48 inches, noncumulative.

3.2 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 8433

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SECTION 09 9114 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation and application of paint systems on exterior substrates.

B. Related Requirements:

1. Section 05 1200 "Structural Steel Framing" for shop priming of metal substrates.
2. Section 05 5000 "Metal Fabrications" for shop priming metal fabrications.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
2. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in the Exterior Painting Schedule for the paint category indicated.

B. Source Limitations: For each system, provide products by the same manufacturer as the topcoat.

2.2 PAINT PRODUCTS

A. MPI Standards: Provide products complying with MPI standards indicated and listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: Where colors are indicated or scheduled, provide colors to match those colors. Where colors are not indicated, provide colors as selected by Architect from manufacturer’s full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions and recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.

2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view:
   a. Equipment, including panelboards[**and switch gear**].
   b. Uninsulated metal piping.
   c. Pipe hangers and supports.
   d. Metal conduit.
   e. Tanks that do not have factory-applied final finishes.

3.4 CLEANING AND PROTECTION

A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Steel and Iron Substrates:

1. Water-Based Light Industrial Coating System MPI EXT 5.1C:
   a. Alkyd Prime Coat: Primer, alkyd, anti-corrosive for metal, MPI #79.
      1) VOC Content: E Range of E2.
   b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
   c. Semigloss Topcoat: Light industrial coating, exterior, water based, semigloss (MPI Gloss Level 5), MPI #163.
      1) VOC Content: E Range of E2.

B. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Coating System [**MPI EXT 5.3J**]:
   a. Acrylic Prime Coat: Primer, galvanized, water based, MPI #134.
      1) VOC Content: E Range of E2.
      2) Environmental Performance Rating: EPR 2.
   b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
   c. Semigloss Topcoat: Light industrial coating, exterior, water based, semigloss (MPI Gloss Level 5), MPI #163.
      1) VOC Content: E Range of E2.

END OF SECTION 09 9114

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SECTION 09 9123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

B. Related Requirements:

1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
3. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
4. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.4 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.5 QUALITY ASSURANCE

A. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

D. Colors: Match colors indicated in a color schedule.

2.2 BLOCK FILLERS

A. Interior/Exterior Latex Block Filler:

1. Products: One of the following:

a. Benjamin Moore; Moorcraft Super Craft Latex Block Filler No. 285: Applied at a dry film thickness of not less than 8.1 mils.
b. Coronado; 946-11 Super Kote 5000 Commercial Latex Block Filler: Applied at a dry film thickness of not less than 8.4 mils.
c. Pittsburgh Paints; 6-7 SpeedHide Interior/Exterior Masonry Latex Block Filler: Applied at a dry film thickness of not less than 6.0 to 12.5 mils.
d. P & L; Pro-Hide Heavy Duty Block Filler Z8465. Applied at a dry film thickness of not less than 6.0 to 12.5 mils.
e. Sherwin-Williams; PrepRite Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils.

2.3 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer:

1. Products: One of the following:

a. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils.
b. Coronado; 40-11 Super Kote 5000 Latex Primer-Sealer: Applied at a dry film thickness of not less than 1.2 mils.
c. Graham; 342-00 Pro Finish Latex Underbody. Applied at a dry film thickness of not less than 1.6 mils.
d. Dulux Paint; 3210-1200 Ultra-Hide Aquacrylic GRIPPER Stain Killer Primer Sealer: Applied at a dry film thickness of not less than 1.8 mils.
e. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil.
f. P & L; Suprime 4 Interior Latex Wall Primer Z/F1004. Applied at a dry film thickness of not less than 1.2 mils.
g. Sherwin-Williams; PrepRite 200 Latex Wall Primer B28W200 Series: Applied at a dry film thickness of not less than 1.6 mils.

B. Interior Plaster Primer/Sealer:

1. Products: One of the following:

a. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils.
b. Coronado; 40-11 Super Kote 5000 Latex Primer-Sealer: Applied at a dry film thickness of not less than 1.2 mils.
c. Graham: 320-00 Aqua Borne Blockout/Undercoat. Applied at a dry film thickness of not less than 2.2 mils.
d. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil.
e. P & L; Suprime 1 100% Acrylic Multi-Purpose Primer Z/F1001. Applied at a dry film thickness of not less than 1.5 mils.
f. Sherwin-Williams; PrepRite 200 Latex Wall Primer B28W200 Series: Applied at a dry film thickness of not less than 1.6 mils.

2.4 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer:

1. Products: One of the following:

a. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils.
b. Coronado; 35-147 Rust Scat Alkyd Metal Primer: Applied at a dry film thickness of not less than 2.0 mils.

c. Graham; 479-91 Aqua Borne Shop Coat Primer. Applied at a dry film thickness of not less than 2 mils.
d. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 1.5 mils.
e. P & L; Suprime 3 Interior/Exterior Latex Metal Primer Z/F1003. Applied at a dry film thickness of not less than 2 mils.
f. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils.

B. Waterborne Galvanized-Metal Primer:

1. Products: One of the following:

a. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils.
b. Coronado; 36-11 Rust Scat Acrylic Metal Primer: Applied at a dry film thickness of not less than 2.0 mils.
c. Graham; 100-00 Aqua Borne Ceramic Universal Primer & Stain Blocker. Applied at a dry film thickness of not less than 1.3 mils.
d. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils.
e. Sherwin-Williams; primer not required over this substrate.

2.5 LATEX PAINTS

A. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).

1. Products: One of the following:

a. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274: Applied at a dry film thickness of not less than 1.2 mils.
b. Coronado; 30-Line Super Kote 5000 Latex Eggshell Enamel: Applied at a dry film thickness of not less than 1.3 mils.
c. Pittsburgh Paints; 6-411C Series SpeedHide Interior Eggshell Latex: Applied at a dry film thickness of not less than 1.0 mil.
d. P & L; Pro-Hide Gold Interior Latex Eggshell Z8200 Series. Applied at a dry film thickness of not less than 2.0 mils.
e. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Eggshell Enamel B31W026 Series: Applied at a dry film thickness of not less than 1.3 mils.

B. Interior Latex (Satin): (Gloss Level 4).

1. Products: One of the following:

a. Benjamin Moore; Moorcraft Super Spec Latex Semi-Gloss Enamel No. 276: Applied at a dry film thickness of not less than 1.2 mils.
b. Coronado; 1160-Line Super Kote 5000 Latex Satin Enamel: Applied at a dry film thickness of not less than 1.3 mils.

c. Pittsburgh Paints; 6-3511C Series SpeedHide Interior Satin Latex: Applied at a dry film thickness of not less than 1.0 mil.
d. P & L; Pro-Hide Gold Interior Latex Satin/Pearl Z9400 Series. Applied at a dry film thickness of not less than 2.0 mils.
e. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Low-Sheen Enamel B24Y026 Series: Applied at a dry film thickness of not less than 1.3 mils.

C. Interior Latex (Semigloss): (Gloss Level 5).

1. Products: One of the following:

a. Benjamin Moore; Moorcraft Super Spec Latex Semi-Gloss Enamel No. 276: Applied at a dry film thickness of not less than 1.2 mils.
b. Coronado; 32-Line Super Kote 5000 Latex Semi-Gloss Enamel: Applied at a dry film thickness of not less than 1.3 mils.
c. Graham; 462-Series Elite Interior Latex Semi-Gloss: Applied at a dry film thickness of not less than 1.2 mils.
d. Pittsburgh Paints; 6-500 Series SpeedHide Interior Semi-Gloss Latex: Applied at a dry film thickness of not less than 1.0 mil.
e. P & L; Pro-Hide Gold Interior Latex Semi-Gloss Z8300 Series. Applied at a dry film thickness of not less than 2.0 mils.
f. Sherwin-Williams; ProMar 200 Interior Latex Semi-Gloss Enamel B31W200 Series: Applied at a dry film thickness of not less than 1.3 mils.

2.6 DRY FOG/FALL COATINGS

A. Latex Dry Fog/Fall:

1. Products: One of the following:

a. Benjamin Moore: Sweep Up Spray Latex - Semi-Gloss, M53S01.
b. Coronado Paint: Super Kote 5000 Dry Fall Semi-Gloss, 131-1.
c. PPG: W.B. Spray Dry Fog -Semi-Gloss, 9650.
d. Sherwin-Williams: Waterborne Acrylic Dry Fall, B42/B75 series.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Masonry (Clay and CMUs): 12 percent.
2. Gypsum Board: 12 percent.
3. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
2. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
3. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
4. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
5. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
6. Wood Substrates:

    a. Scrape and clean knots, and apply coat of knot sealer before applying primer.
    b. Sand surfaces that will be exposed to view, and dust off.
    c. Prime edges, ends, faces, undersides, and backsides of wood.
    d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

7. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.
8. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.
9. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

B. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work. Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Tanks that do not have factory-applied final finishes.
e. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
f. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:

a. Switchgear and Panelboards.
b. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces flat black.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. Latex System:

a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior Satin (MPI Gloss Level 4), MPI #43.

B. Galvanized-Metal Substrates:

1. Latex System, Waterborne Primer:

a. Prime Coat: Primer, Waterborne Galvanized-Metal Primer:
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

C. Steel Substrates:

1. Latex System, Alkyd Primer:

a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

2. Water-Based Dry-Fall System:

    a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
    b. Topcoat: Dry fall, latex semi-gloss (MPI Gloss Level 5), MPI #226.

D. Gypsum Board Substrates:

1. Latex over Latex Sealer System (Apply to Ceilings unless indicated otherwise):

    a. Prime Coat: Primer sealer, latex, interior, MPI #50.
    b. Intermediate Coat: Latex, interior, matching topcoat.
    c. Topcoat: Latex, interior Eggshell (MPI Gloss Level 3), MPI #52.

2. Latex over Latex Sealer System (Apply to Walls unless indicated otherwise):

    a. Prime Coat: Primer sealer, latex, interior, MPI #50.
    b. Intermediate Coat: Latex, interior, matching topcoat.
    c. Topcoat: Latex, interior satin (MPI Gloss Level 4), MPI #43.

3. Latex over Latex Primer System (for Plaster Only):

    a. Prime Coat: Plaster primer sealer, latex, interior.
    b. Intermediate Coat: Latex, interior, matching topcoat.
    c. Topcoat: Latex, interior eggshell (MPI Gloss Level 3), MPI #52.

E. Cotton or Canvas Insulation-Covering Substrates: Including pipe and duct coverings.

1. Latex System:

    a. Prime Coat: Primer sealer, latex, interior, MPI #50.
    b. Intermediate Coat: Latex, interior, matching topcoat.
    c. Topcoat: Latex, interior eggshell (MPI Gloss Level 3), MPI #52.

END OF SECTION 09 9123

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SECTION 10 1100 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Visual display board assemblies.

B. Related Requirements:

1. Section 09 7723 "Fabric-Wrapped Panels" for tackable, fabric-covered panels mounted on walls.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work.
2. Show locations of panel joints
3. Show locations and layout of special-purpose graphics.

C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:

1. Samples of facings for each visual display panel type, indicating color and texture.
2. Fabric swatches of fabric facings for tackboards.

D. Product Schedule: For visual display units.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display units to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.2 VISUAL DISPLAY BOARD ASSEMBLIES

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

1. CIG-JAN Products, Ltd.
2. Claridge Products and Equipment, Inc.
3. Marsh Industries, Inc.
4. Platinum Visual Systems.
5. PolyVision Corporation, a Steelcase company.

B. Visual Display Board Assembly (MB-#): factory fabricated.

1. Assembly: Markerboard.
2. Corners: Square.
3. Widths: As indicated on Drawings.
4. Heights: As indicated on Drawings.
5. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.
   a. Color: As selected by Architect from full range of industry colors.

C. Visual Display Board Assembly (TB-#): 1/4-inch (6 mm) thick self-healing, burlap backed cork laminated to 1/4-inch hardboard backing, factory fabricated.

1. Assembly: Tackboard.
2. Corners: Square.

3. Widths: As indicated on Drawings.
4. Heights: As indicated on Drawings.
5. Tackboard Panel: Color-impregnated-cork tackboard panel on core indicated.

    a. Color and Pattern: As selected by Architect from full range of industry colors.

D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; standard size and shape.

1. Aluminum Finish: Clear anodic finish.

E. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

1. Joints between Markerboard Sections: Hidden spline between abutting sections.
2. Combination Assemblies: Provide H-trim between abutting sections of visual display panels.

F. Chalktray: Manufacturer's standard; continuous.

1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

    a. Include chalktray on 4 ft. high markerboards only.

G. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, and continuous paper holder, designed to hold accessories.

1. Size: 1 to 2 inches high by full length of visual display unit.
2. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of display rail or fraction thereof.
3. Tackboard Insert Color: As selected by Architect from full range of industry colors.
4. Aluminum Color: Match finish of visual display assembly trim.

2.3 MARKERBOARD PANELS

A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with high-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.

1. Face Sheet Thickness: 0.021 inch uncoated base metal thickness.
2. Particleboard Core: 3/8 inch thick; with 0.005-inch- thick, aluminum foil backing.
3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.4 TACKBOARD PANELS

A. Tackboard Panels:

1. Facing: 1/4-inch- thick, plastic-impregnated cork.
2. Core: 1/4-inch- thick hardboard.

2.5 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

B. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish; with surface-burning characteristics indicated.

C. Plastic-Impregnated-Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout; with surface-burning characteristics indicated.

D. Hardboard: ANSI A135.4, tempered.

E. Particleboard: ANSI A208.1, Grade M-1.

F. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
2. Where size of visual display board assemblies or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

C. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.

3.2 CLEANING AND PROTECTION

A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 10 1100

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SECTION 10 1419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fabricated channel dimensional characters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

B. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 DIMENSIONAL CHARACTERS

A. Cutout Characters (Exterior Locations): Characters with uniform faces; square-cut, smooth, eased edges; precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Diskey Architectural Signage Inc.
   b. Valley City Signs.
   c. Fast Signs.
   d. Midwest Sign Company.
   e. Postema Sign & Graphics.
   f. Valley City Signs.

2. Character Material: Sheet or plate aluminum.
3. Character Height: As indicated on Drawings.
4. Thickness: 0.25 inch.
5. Finishes:
   a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.

6. Mounting: Concealed studs.
7. Typeface: Century Gothic.

B. Cutout Characters (Interior Locations): Characters with uniform faces; square-cut, smooth, eased edges; precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Diskey Architectural Signage Inc.
   b. Valley City Signs.
   c. Fast Signs.
   d. Midwest Sign Company.
   e. Postema Sign & Graphics.

2. Character Material: Sheet or plate acrylic.
3. Character Height: As indicated on Drawings.
4. Thickness: 0.25 inch.
5. Finishes:
   a. Baked-Enamel or Powder-Coat Finish: Match Pantone Reflex Blue.

b. Overcoat: Manufacturer's standard baked-on clear coating.

6. Mounting: Concealed studs.
7. Typeface: Century Gothic.

2.3 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel or hot-dip galvanized devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:
   a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
   b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.

4. Sign Mounting Fasteners:
   a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.

5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.6 FINISH REQUIREMENTS

A. General: Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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.
2. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

B. Aluminum Finishes:

1. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
2. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 INSTALLATION OF DIMENSIONAL CHARACTERS

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
   a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
   b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 10 1419

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SECTION 10 1426 - POST AND PANEL-PYLON SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonilluminated post-and-panel signs.

B. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for concrete foundations, concrete fill in postholes, and setting anchor bolts in concrete foundations for signs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signage.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly, showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

E. Product Schedule: For post-and-panel and pylon signs. Use same designations indicated on Drawings or specified.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

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.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. 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 sign structure and anchorage of post-and-panel sign type(s) according to structural performance requirements.

B. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

C. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 POST-AND-PANEL SIGNS

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

1. ACE Sign Systems, Inc.
2. Allen Industries Architectural Signage.
3. APCO Graphics, Inc.
4. ASI Sign Systems, Inc.
5. Diskey Architectural Signage Inc.
6. Nelson-Harkins Industries.
7. Poblocki Sign Company, LLC.
8. Stamprite Supersine; Foresight Group
9. Fast Signs.
10. Midwest Sign Company
11. Postema Sign & Graphics
12. Valley City Sign Company

B. Post-and-Panel Sign: Sign of single-panel configuration; with smooth, uniform surfaces and support assembly; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Solid-Sheet Sign Panels: Aluminum sheet with finish specified in "Sign-Panel-Face Finish and Applied Graphics" Subparagraph and as follows:
   a. Thickness: Manufacturer's standard for size of sign.
   b. Surface-Applied Graphics: Applied baked enamel or powder coat.

2. Single-Panel Sign Frame: Entire perimeter.
   a. Material: Aluminum.
   b. Frame Depth: 4 inches by 4 inches.
   c. Profile: Square.
   d. Corner Condition in Elevation: Square.
   e. Finish and Color: Match sign-panel face.

3. Sign-Frame Mounting: Between posts.
4. Posts: Aluminum.
   a. Shape: Semicircular.
   b. Size: 3.5 by 7 inches.
   c. Installation Method: Sleeve.
   d. Finish and Color: As selected by Architect from manufacturer's full range. Match existing campus / district signage.

5. Sign-Panel-Face Finish and Applied Graphics:
   a. Baked-Enamel or Powder-Coat Finish and Graphics: Manufacturer's standard, in color as selected by Architect from manufacturer's full range. Match existing campus / school district signs.
   b. Overcoat: Manufacturer's standard baked-on clear coating.

6. Text and Typeface: Match existing campus / school district signs..

2.3 MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:

1. Use concealed fasteners and anchors unless indicated to be exposed.

2. For exterior exposure, furnish stainless-steel or hot-dip galvanized devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:
   a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
   b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant, Allen-head slots unless otherwise indicated.

4. Inserts: Furnish inserts to be set by other installers into concrete or masonry work.

B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing signs with imposed loads to structure.
2. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

D. Anchoring Materials:

1. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
2. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
   a. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of flux, and dress exposed and contact surfaces.
3. Conceal fasteners and anchors unless indicated to be exposed; locate exposed fasteners where they will be inconspicuous.
4. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.

B. Sign Message Panels: Construct sign-panel surfaces to be smooth and to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.

1. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.

2. Increase panel thickness or reinforce with concealed stiffeners or backing materials as needed to produce surfaces without distortion, buckles, warp, or other surface deformations.
3. Continuously weld joints and seams unless other methods are indicated; grind, fill, and dress welds to produce smooth, flush, exposed surfaces with welds invisible after final finishing.

C. Post Fabrication: Fabricate posts designed for structural performance indicated and of lengths required for installation method indicated for each sign.

1. Aluminum Posts: Manufacturer's standard 0.125-inch- thick, extruded-aluminum tubing unless otherwise indicated, with brackets or slots to engage sign panels.
2. Sleeves: Fabricate posts 12 inches longer than height of sign to permit embedment in sleeves cast in concrete foundations or concrete-filled postholes. Provide sleeves by manufacturer, sized to receive outside diameter of posts. Size sleeves for direct embedment in concrete foundations or concrete-filled postholes and to prevent sign movement, but not less than 36 inches for embedment.

2.6 FINISH REQUIREMENTS

A. General: Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using installation methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign components are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 INSTALLING POSTS

A. Vertical Tolerance: Set posts plumb within a tolerance of 1/16 inch in 3 feet.

B. Sleeve Method: Set post in position in sleeve and support post to prevent movement, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with manufacturer's written instructions.

1. Leave anchorage joint exposed with 1/8-inch anchoring material sloped away from post.

END OF SECTION 10 1426

SECTION 10 1453 - TRAFFIC SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes traffic signs.

B. Related Sections include the following:

1. Division 10 Section "Signage" for building signage.
2. Division 10 Section "Post and Panel/Pylon Signs" for sight identification signage.
3. Division 31 Section "Earth Moving" for excavation and backfilling.

1.2 SUBMITTALS

A. Product Data: For each type of sign.

B. Material Certificate: Signed by manufacturer stating that products comply with the requirements.

1.3 QUALITY ASSURANCE

A. Comply with MDOT standards.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Sheet: ASTM B 209, 6061-T6, minimum 0.080 inch thick.

B. Reflective Sign Graphic and Coating: In conformance with MDOT standards.

C. Post: ASTM A702 Type A or Type B steel, hot-dip galvanized after fabrication in accordance with MDOT standards and as follows:

1. Square Tube Posts: 3-inch square with 3/16-inch minimum wall thickness.

D. Post Sleeve: PVC pipe.

E. Concrete: In accordance with Division 03 Section “Cast-In-Place Concrete” with not less than 3000-psi compressive strength (28 days).

F. Concrete: Portland cement complying with ASTM C 150, Type I aggregates complying with ASTM C 33, and potable water.

1. Concrete Mixes: Normal-weight concrete air entrained with not less than 3000-psi compressive strength (28 days), 3-inch slump, and 1-inch maximum size aggregate.

2.2 SIGNS

A. Fabricate signs with graphics and in sizes as indicated on Drawings, in accordance with MDOT standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount signs with posts plumb in accordance with MDOT standards at heights indicated on Drawings. Imbed posts as indicated on Drawings.

1. Signs Mounted in Soil: Firmly pack soil around sign post for rigid installation.
2. Signs Mounted in Concrete Footings: Set post in sleeve cast into concrete. Firmly pack sand in space between sign and sleeve.

END OF SECTION 10 1453

SECTION 10 2113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for blocking.
2. Section 09 2216 "Non-Structural Metal Framing" for blocking.
3. Section 10 2800 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product

B. Shop Drawings: For solid-plastic toilet compartments. Include plans, elevations, sections, details, and attachment details.

C. Samples for Verification: Actual sample of finished products for each type of toilet compartment indicated.

1. Size: 6-inch- square, of same thickness indicated for Work.
2. Include each type of hardware and accessory.

D. Delegated Design Submittals: For grab bars mounted on toilet compartment panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Product Certificates: For each type of toilet compartment by manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of partitions that fail in materials or workmanship within specified warranty period.

1. Warranty Period - Material: Manufacturer's standard, but not less than Twenty (20) years from date of Substantial Completion against delamination, breakage or corrosion on all materials.
2. Warranty Period – Installation and labor: Three (3) years from Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Department of Justice "2010 ADA Standards for Accessible Design" and ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

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

1. ASI Accurate Partitions.
2. ASI Global Partitions.
3. American Sanitary Partition Corporation.
4. Bradley Corp.
5. General Partitions Mfg. Corp.
6. Hadrian Inc.; Zurn Industries, LLC.
7. Metpar Corp.
8. Scranton Products.

B. Toilet-Enclosure Style: Overhead braced .

C. Urinal-Screen Style: Wall hung. Urinal screens shall extend a minimum of 21 inches from the wall, and a minimum of 6 inches beyond the outermost front lip of the urinal measured from the finished backwall surface, whichever is greater.

D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, . and with homogenous color and pattern throughout thickness of material.

1. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
2. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range.

E. Pilaster Shoes: Manufacturer's standard design; stainless steel.

F. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; extruded aluminum or stainless steel.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories, Heavy Duty: Manufacturer's heavy-duty operating hardware and accessories.

1. Hinges: Manufacturer's minimum 0.062-inch- thick stainless steel paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door. Mount with through bolts.
2. Latch and Keeper: Manufacturer's heavy-duty, surface-mounted, cast-stainless steel latch unit, designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through bolts.
3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless steel hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories. Mount with through bolts.
4. Door Bumper: Manufacturer's heavy-duty, rubber-tipped, cast-stainless steel bumper at outswinging doors. Mount with through bolts.
5. Door Pull: Manufacturer's heavy-duty, cast-stainless steel pull at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through bolts.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221.

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

D. Stainless Steel Castings: ASTM A743/A743M.

E. Solid, high-density polyethylene (HDPE): Provide high density polyethylene (HDPE) suitable for exposed application. Waterproof, non-absorbent and graffiti resistant textured surface. Tensile Strength Yield 4000 psi ASTM D638. Hardness: Shore D69 ASTM D2240. Impact Strength: Izod, Notched 10 foot-lbs. Flexural Modulus Yield: 200,000 psi ASTM D790. Specific Gravity: 0.96 min.

2.5 FABRICATION

A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, inswinging doors for standard toilet compartments and 36-inch- wide, outswinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:
    a. Pilasters and Panels: 1/2 inch.
    b. Panels and Walls: 1 inch.

2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
    a. Locate bracket fasteners, so holes for wall anchors occur in masonry or tile joints.
    b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels and adjust, so tops of doors are parallel with overhead brace when doors are in closed position.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION 10 2113.19

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SECTION 10 2123 - CUBICLE CURTAINS AND TRACK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cubicle-curtain tracks and carriers.
2. Cubicle curtains.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for supplementary wood framing and blocking for mounting items requiring anchorage.
2. Section 09 2216 "Non-Structural Metal Framing" for supplementary metal framing and blocking for mounting items requiring anchorage.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For curtains and tracks.

1. Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
2. Include details of blocking for track support.

C. Samples for Initial Selection: For each type of curtain material indicated.

D. Samples for Verification: For each type of product required, prepared on Samples of size indicated below:

1. Curtain Fabric: Not less than 10 inches square and showing complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
2. Mesh Top: Not less than 10 inches square.
3. Curtain Track: Not less than 10 inches long.
4. Curtain Carrier: Full-size unit.

E. Product Schedule: For curtains and tracks. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Cubicle Curtains: Provide curtain fabrics as indicated in material selection schedule on drawings and in compliance with the following characteristics:

1. Flame Resistance: Provide fabrics identical to those that have passed NFPA 701 when tested by a qualified testing agency acceptable to authorities having jurisdiction.
   a. Identify fabrics with appropriate markings of a qualified testing agency.

2.2 CUBICLE-CURTAIN SUPPORT SYSTEMS

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

1. Imperial Fastener Company, Inc.

B. Extruded-Aluminum Curtain Track: Not less than 1-1/4 inches wide by 3/4 inch high.

1. Track Minimum Wall Thickness: 0.058 inch.
2. Curved Track: Factory-fabricated, 12-inch- radius bends.
3. Finish: Baked enamel, acrylic, or epoxy.

C. Curtain Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.

1. End Stop: Removable with carrier hook.

D. Breakaway Curtain Carriers: Velcro breakaway curtain carriers designed to allow curtains to detach from tracks with a pulling force of no more than 5 lbf.

E. Exposed Fasteners: Stainless steel.

F. Concealed Fasteners: Hot-dip galvanized.

2.3 CURTAINS

A. Curtains: Contractor furnished, and Contractor installed.

B. Fabric (CC-1): Curtain manufacturer's standard, 100 percent polyester; inherently and permanently flame resistant, stain resistant, and antimicrobial.

1. Product: Subject to compliance with requirements, provide the following:
   a. Symmetry Resources.

2. Pattern:Ara .
3. Width: 72.75 inches.
4. Color:As noted within Material Selection Schedule.

C. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.

D. Mesh Top: Not less than 22-inch- high mesh top.

1. Mesh: No. 50 nylon mesh.

E. Curtain Tieback: Nickel-plated brass chain; one at each curtain termination.

2.4 CURTAIN FABRICATION

A. Continuous Curtain Panels:

1. Width: Equal to track length from which curtain is hung plus 10 percent of added fullness, but not less than 12 inches of added fullness.
2. Top Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lockstitched.
3. Mesh Top: Top hem of mesh not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lockstitched. Double lockstitch bottom of mesh directly to 1/2-inch triple thickness, top hem of curtain fabric.
4. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, double thickness and double lockstitched.
5. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with double turned edges, and single lockstitched.
6. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install tracks level and plumb, according to manufacturer's written instructions.

B. For tracks of up to 20 feet in length, provide track fabricated from single, continuous length.

1. Curtain-Track Mounting: Surface.

C. Surface-Track Mounting: Fasten tracks to ceilings at intervals recommended by manufacturer. Fasten tracks to structure at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:

1. Mechanically fasten directly to finished ceiling with toggle bolts.
2. Mechanically fasten to suspended ceiling grid with screws.

D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

1. Provide one hinged loading unit for each bed.

E. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.

F. Cubicle Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

END OF SECTION 10 2123

SECTION 10 2600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Corner guards.
2. Rigid sheet wall protection

B. Related Requirements:

1. Section 05 5000 "Metal Fabrications" for metal fabrications, and pipe and tube railings.
2. Section 08 7100 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details. Show handrail design and support spacing required to withstand structural loads.

C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.

1. Include Samples of accent strips and accessories to verify color selection.

D. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long. Include example top caps.
2. Rigid sheet wall protection: no less than 6 by 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Material certificates.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
   b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.3 CORNER GUARDS

A. Manufacturers: provide products indicated in drawings on material selection schedule:

B. Surface-Mounted, Opaque-Plastic Corner Guards: Fabricated as one piece from PVC plastic; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.

1. Product:InPro Corporation; Tape-On Corner Guard.
2. Wing Size: As indicated on material selection schedule.
3. Length: As indicated on Material Selection Schedule.
4. Mounting: Adhesive.
5. Color and Texture: As indicated on Material Selection Schedule.

2.4 RIGID SHEET WALL PROTECTION

A. Rigid Sheet Wall Covering (IRWP): Fabricated from semirigid, plastic sheet wall-covering material: as indicated on Material Selection Schedule.

1. Size: As indicated.
2. Sheet Thickness: 0.040 inch.
3. Color and Texture: As indicated on Material Selection Schedule.
4. Height: As indicated on Drawings.
5. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color.
6. Mounting: Adhesive.

2.5 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D 256, Test Method A.

C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

D. Adhesive: As recommended by protection-product manufacturer and with a VOC content of 70 g/L or less.

E. Adhesive: As recommended by protection-product manufacturer and that complies 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."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
3. Adjust end and top caps as required to ensure tight seams.

D. Rigid sheet wall protection: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.2 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 2600

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Hand dryers.
4. Childcare accessories.
5. Underlavatory guards.
6. Custodial accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

C. Delegated-Design Submittal: For grab bars, shower seats,.

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Hand Dryers: Manufacturer agrees to repair or replace hand dryers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials: soap dispenser, paper towel dispenser, toilet paper dispenser, sanitary napkin dispenser (if any), trash receptacle .

2.2 PERFORMANCE REQUIREMENTS

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.

B. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
2. Shower Seats: Installed units are able to resist 400 lbf applied in any direction and at any point.
3. Diaper Changing Stations: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Basis-of-Design Products: Subject to compliance with requirements, provide basis-of-design product indicated, or a comparable product by one of the following:

1. AJW Architectural Products.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. GAMCO Specialty Accessories; a division of Bobrick.

B. Toilet Tissue (Roll) Dispenser: Surface mounted, Owner furnished and Contractor installed.

C. Paper Towel Dispenser: Surface mounted, Owner furnished and Contractor installed.

D. Soap Dispenser: Surface mounted, Owner furnished and Contractor installed.

E. Grab Bar:

1. Mounting: Flanges with concealed fasteners.
2. Material: Stainless steel, 0.05 inch thick.
   a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.

3. Outside Diameter: 1-1/2 inches.
4. Configuration and Length: As indicated on Drawings.

F. Vendor: Surface mounted, Owner furnished and Contractor installed.

G. Sanitary-Napkin Disposal Unit:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-270.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

H. Mirror Unit:

1. Frame: Stainless steel angle, 0.05 inch thick.
   a. Corners: Welded and ground smooth.

2. Size: 18 by 34 inches unless indicated otherwise.
3. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

I. Hook:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-76727.
2. Description: Double-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.4 PUBLIC-USE SHOWER ROOM ACCESSORIES

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

B. Basis-of-Design Products: Subject to compliance with requirements, provide basis-of-design product indicated, or a comparable product by one of the following”

1. AJW Architectural Products.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. GAMCO Specialty Accessories; a division of Bobrick.

C. Shower Curtain Rod:

1. Description: 1-1/4-inch- outside diameter, straight rod.
2. Configuration: Curved
3. Mounting Flanges: Concealed fasteners; in material and finish matching rod.
4. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

D. Shower Curtain:

1. Sizes: 72 inches(1828 mm) high by width as follows:
   a. Openings less than 48 inches(1219 mm) Wide: 6 inches(152 mm) wider than opening.

b. Openings 48 inches(1219 mm) Wide or Wider: 12 inches(305 mm) wider than opening.

2. Size: Minimum [**6 inches**] [**12 inches**] wider than opening by 72 inches high.
3. Material: Nylon-reinforced vinyl, minimum 9 oz. or 0.008-inch- thick vinyl, with integral antibacterial and flame-retardant agents.
4. Color: White.
5. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
6. Shower Curtain Hooks: Chrome-plated or stainless steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

E. Folding Shower Seat:

1. Basis-of-Design Product: American Specialties, Inc.; 8203-33.
2. Configuration: Rectangular seat.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Dimensions: Minimum 31-1/2 inches(800 mm) wide by nominal 16 inches(406 mm) deep.

F. Soap Dish:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-680.
2. Mounting: Surface mounted.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.5 HAND DRYERS

A. High-Speed Air Dryer:

1. Product: Basis of Design: Dyson Airblade V HU2.
2. Description: High-speed, unheated-air hand dryer for rapid hand drying.
3. Mounting: Surface mounted.
   a. Protrusion Limit: Installed unit protrudes maximum 4 inches from wall surface.

4. Operation: Infrared-sensor activated with timed power cut-off switch.
   a. Average Dry Time: 15 seconds.
   b. Automatic Shut Off: At 30 seconds.

5. Maximum Sound Level: [79dB. Sound level at 2 meters max 63 dB.
6. Cover Material and Finish: Molded plastic, white.
7. Electrical Requirements: 115 V, 13 A, 1500 W.

2.6 CHILDCARE ACCESSORIES

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

1. American Specialties, Inc.
2. Foundations Children’s Products.
3. GAMCO Specialty Accessories; a division of Bobrick.
4. Koala Kare Products; a division of Bobrick.

B. Diaper-Changing Station:

1. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
   a. Engineered to support minimum of 250-lb static load when opened.
2. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
3. Operation: By pneumatic shock-absorbing mechanism.
4. Material and Finish: HDPE in manufacturer's standard color.
5. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

2.7 UNDERLAVATORY GUARDS

2.8 CUSTODIAL ACCESSORIES

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

1. AJW Architectural Products.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. GAMCO Specialty Accessories; a division of Bobrick.

B. General: Refer to "Public-Use Washroom Accessories" Article for accessories in custodial areas not listed in this Article.

C. Mop and Broom Holder:

1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-223.
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches (914 mm).
4. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.9 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

C. Shower Seats: Install to comply with specified structural-performance requirements.

END OF SECTION 10 2800

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 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fire-protection cabinets.

C. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.

D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 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. JL Industries, Inc.; a division of the Activar Construction Products Group.
2. Larsens Manufacturing Company.
3. Nystrom, Inc.
4. Potter Roemer LLC.

B. Cabinet Type (FEC): 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: Aluminum 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.

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. Aluminum: ASTM B 221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.
   a. Finish: Clear anodic.

3. 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."
2. Section 23 3813 "Commercial-Kitchen Hoods" for fire-extinguishing systems provided as part of commercial-kitchen exhaust hoods.

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 (FE-): 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 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.
   a. Orientation: Vertical.

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 10 5113 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Corridor lockers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, and attachment details.
2. Include locker identification system and numbering sequence.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.

D. Samples for Verification: For the following products, in manufacturer's standard size:

1. Lockers and equipment.

E. Product Schedule: For lockers. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CORRIDOR LOCKERS

A. Knocked-Down Corridor Lockers :

1. Products: Subject to compliance with requirements, provide one of the following:
   a. AJW Architectural Products; AJW Standard Series Metal Lockers.
   b. Art Metal Products;
   c. ASI Storage Solutions; ASI Group; Traditional.
   d. General Storage Systems Ltd.; Elite.
   e. Hadrian Manufacturing Inc; Emperor.
   f. List Industries Inc.; Classic KD.
   g. Lyon Workspace Products, LLC; Standard.
   h. Olympus Lockers & Storage Products, Inc.; Standard KD.
   i. Penco Products, Inc; Guardian.
   j. Republic Storage Systems, LLC; Standard.

2. Locker Size: 12 inches wide by 18 inches deep by 60 inches high.
3. Locker Arrangement: Single tier.
4. Doors: One piece; fabricated from 0.060-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
   a. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
   b. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch nominal-thickness steel sheet; welded to inner face of doors.
   c. Door Style: Vented panel as follows:
      1) Louvered Vents: No fewer than six louver openings at top and bottom for single-tier lockers.

5. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
   a. Tops, Bottoms, and Intermediate Dividers: 0.024-inch nominal thickness, with single bend at sides.
   b. Backs and Sides: 0.024-inch nominal thickness, with full-height, double-flanged connections.
   c. Shelves: 0.024-inch nominal thickness, with double bend at front and single bend at sides and back.

6. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
7. Hinges:
   a. Hinges: Manufacturer's standard, steel, continuous or knuckle type.

8. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

a. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic latching and prelocking.
   1) Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
   2) Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism.

9. Locks: Combination padlocks provided by owner.
10. Identification Plates: Manufacturer's standard, etched, embossed, or stamped plates, with numbers and letters at least 3/8 inch high.
11. Hooks: Manufacturer's standard ball-pointed hooks, aluminum or steel; zinc plated.
12. Continuous Zee Base: Fabricated from manufacturer's standard thickness, but not less than 0.060-inch nominal-thickness steel sheet.
    a. Height: 4 inches.

13. Continuous Sloping Tops: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch nominal-thickness steel sheet.
    a. Closures: Hipped-end type.

14. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet.
15. Materials:
    a. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

16. Finish: Baked enamel or powder coat.
    a. Color: As selected by Architect from manufacturer's full range.

2.2 LOCKS

A. Combination Padlock: Provided by Owner.

2.3 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Equipment: Provide each locker with an identification plate and the following equipment:

   1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.

D. Knocked-Down Construction: Fabricate metal lockers by assembling at Project site, using manufacturer's nuts, bolts, screws, or rivets.

E. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Lockers: Assemble with manufacturer's standard fasteners, with no exposed fasteners on door faces or face frames.

C. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach filler panels with concealed fasteners.
2. Attach sloping-top units to metal lockers, with closures at exposed ends.
3. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

END OF SECTION 10 5113

SECTION 10 7516 - GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes ground-set flagpoles made from aluminum.

B. Owner-Furnished Material: Flags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: For flagpoles.

1. Include plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
2. Include section, and details of foundation system.

C. Delegated-Design Submittal: For flagpoles.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, 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 flagpole assemblies.

B. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.

1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is 90 mph(145 kph),.
2. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.3 ALUMINUM FLAGPOLES

A. Aluminum Flagpoles: Cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Flagpole; a Kearney-National Inc. company.
   b. Concord Industries, Inc.
   c. Eder Flag Manufacturing Company, Inc.
   d. Kalamazoo Flag Company
   e. Pole-Tech Company Inc.

2. Exposed Height: 30 feet.
3. Finial: Ball.
4. Halyard: Internal winch system for one flag, 5 by 8 feet.
5. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
   a. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
   b. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

6. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch- diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.
   a. Flashing Collar: Same material and finish as flagpole.

2.4 FITTINGS

A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.

1. 0.063-inch spun aluminum, finished to match flagpole.

B. Internal Halyard, Cam Cleat System: 5/16-inch- diameter, braided polypropylene halyard; cam cleat; and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

1. Halyard Flag Snaps: Stainless-steel swivel snap hooks with neoprene or vinyl covers. Furnish two per flag.

2.5 MISCELLANEOUS MATERIALS

A. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

B. Sand: ASTM C 33/C 33M, fine aggregate.

C. Elastomeric Joint Sealant: Single-component neutral-curing silicone joint sealant complying with requirements in Section 07 9200 "Joint Sealants."

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.6 FINISHES

A. Aluminum Finishes:

1. Clear Anodic Finish: AAMA 611, AA-M12C22A41or AA-M12C22A31.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.

D. Place concrete, as specified in Section 03 3000 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.

B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION 10 7516

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SECTION 11 4000 - FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All Drawings, General and Supplementary Conditions, Division 1, Specifications, and related contract documents apply to this section and the requirements may exceed those shown in this section. The Food Service Engineering Consultants on this project are JRA Food Service Consultants, LLC in Grand Rapids, Michigan (616-454-4433) and is responsible to the Architect and Owner for ascertaining that the Food Service Equipment Contractor complies with all the requirements of this section.

1.2 SUMMARY

A. As listed in this division, the Food Service Equipment Contractor shall furnish all labor, material, work, equipment, transportation, accessories, taxes, etc. for a complete and continuous installation in accordance with the requirements of these plans and specifications and related documents.

B. The FSEC shall familiarize themselves with local conditions affecting the cost of the work and examine the site and all Food Service Equipment contract documents including Architectural drawings, and contract documents, all of which constitute the responsibility of the FSEC.

1.3 SUBSTITUTIONS AND VOLUNTARY ALTERNATES:

A. The first manufacturer of equipment listed in the item specifications is intended to be the basis of the base bid. All other manufacturers must conform to the specifications, size, accessories, materials, capacity, etc.

B. A proposed substitution on any specified equipment must be submitted to the Consultant 10 days in advance of the bid date and must include all manufacturers shop drawings and data sheets on the proposed equipment. The supplier shall pay any additional costs incurred for changes, engineering services, utilities, construction, etc. that may be incurred by said substitutions.

1.4 INTERPRETATION OF DOCUMENTS:

A. Prior to receipt of bids, all questions, clarification, and changes in the documents shall be executed by addendum. After award of contract, all changes shall be performed by bulletin.

B. FSEC shall submit an itemized price breakdown to the Consultant on their letterhead for each piece of equipment including labor, freight, manufacturer, quantity, taxes, etc. as applicable.

C. Any deletions of equipment by the Owner and/or Consultant prior to approval and/or release of the shop drawings, brochures, etc. shall be credited to the Owner at the itemized price as listed in the itemized price breakdown and include all equipment costs, freight, labor, taxes etc. Pricing shall not be credited at the amount listed on the Schedule of Values.

D. Any additions to equipment by the Owner and/or Consultant that result in cost increases after approval and/or release of shop drawings, brochures, etc. shall be immediately noted by the FSEC and a written request with prices for a bulletin shall be issued by the FSEC to the Consultant.

E. The General Specifications are applicable to items listed in the item specifications.

1.1 ABBREVIATIONS

A. The following abbreviations are used herein unless otherwise noted on the plans or item specifications.

A	Amps
AFF	Above Finish Floor
BTC	Branch To Connection
CFM	Cubic Feet of Air Per Minute
C.P.	Chrome Plated
CW	Cold Water - 25 PSI
DCO	Duplex Convenience Outlet - 20 amp
DFA	Drop From Above
E.C.	Electrical Trades
FL DR	Floor Drain - Wade W1104
FFD	Funnel Floor Drain - Wade 1104-EF4
FL SK	Floor Sink - 12" - Wade W9144-15
FPM	Feet Per Minute
FSEC	Food Service Equipment Contractor
F.S.C.	Food Service Consultant
G	Natural Gas - 7" water column
GP	General Purpose
G.S.	General Specifications
G.C.	General Trades
HVAC	Heating Ventilation HVAC Trades
HP	Horsepower
HW	Hot Water - 140 degree - 25 PSI
J.B.	Junction Box
KW	Kilowatt
N.S.R.	No Service Required
N.I.C.	Not in FSEC contract
P.C.	Plumbing Trades
S.O.M.	Standard of Manufacturer
s.s.	Stainless Steel
SS	Steam Supply - 25 PSI
SR	Steam Return
V	Volts
VIF	Verify in field
W	Waste Outlet
W.G.	Water Gauge - Static Pressure

1.2 CONFORMITY

A. All equipment furnished under these specifications shall be newly manufactured and installed in strict conformity with all codes, regulations and requirements of the State Board of Health, the National Sanitation Foundation Standards, or any state or local agency.

B. All equipment shall conform to the current standards and bear the seal of UL, NEMA, ASME, AGA, OSHA, NFPA, etc. where applicable and/or otherwise conform to the requirements of the authorities having jurisdiction.

C. Wherever the requirements of the specifications and drawings are in excess of the regulations, the specifications and drawings shall govern. Whenever the regulations are in excess of the specifications and drawings, the regulations shall govern.

D. Wherever the requirements of the specifications are in excess of the drawings, the specifications shall govern.

E. Wherever the requirements of the drawings are in excess of the specifications, the drawings shall govern.

1.3 PERMITS - LICENSES - PHONE CALLS

A. Provide to the proper authorities all notices required by law, obtain all refrigeration permits, licenses, etc., and pay any legal fees necessary for the due and faithful performance of the work, and which may arise incidental to the fulfilling of the foodservice documents. The Owner shall pay for any health department plan review or license fees.

B. Permits shall be provided as required. Refer to the Construction Managers scope of work.

C. Accept all collect phone calls relating to food service equipment that pertain to the project until warranty has expired on the equipment.

1.4 SUBMITTAL OF BUYOUT BROCHURES AND SHOP DRAWINGS

A. Shop drawing and brochure requirements may also be listed in the general requirements or other areas of the documents. Provide submittals as per those requirements or as listed below - whichever is greater.

B. All shop drawings, rough-in drawings, equipment brochures, etc. shall be submitted at one time within 20 days of the notice to proceed. Said items are subject to the terms and conditions of the plans and specifications for the entire project. All drawings which are submitted for distribution shall be clear and concise and have the following notes printed on each and every sheet:

Name of the F.S.E.C.
Name and location of the project.
Name of the Architect.
Name of the Consultant.
Name of the General Contractor.
Drawing number.
Date of drawing and revisions.

The following statement: The (name of F.S.E.C.) is solely responsible for the accuracy and completeness of these drawings and specifications, and we approve them for construction purposes. Signed: (Officer, Partner, etc.)

C. All submitted data shall be reviewed for general compliance only and does not alleviate the F.S.E.C. from providing equipment as per the intent of the plans and specifications.

D. Owner shall not be responsible for any equipment ordered or prior to receipt of approved brochures or shop drawings. Consultant

E. If applicable, the F.S.E.C. shall visit site to verify requirements of existing or relocated equipment prior to submittals.

1.5 BUYOUT BROCHURES:

A. As soon as possible, prepare a buy-out equipment brochure in PDF format with copies of manufacturer's specification sheet or literature on each item, along with a list of the model, manufacturer, quantity, connections required, accessories, etc. for each item and component or accessories. Material on all items shall be assembled in order and no consideration will be given to partial lists submitted from time to time.

1.6 ROUGH-IN DRAWING AND MECHANICAL DATA:

A. As soon as possible, submit an electronic drawing in PDF format at 1/4” scale to locate accurately the utility connections for each item of equipment requiring water, gas, electrical, and drain. Listed on the drawings shall be dimensions to required utilities and located from a center line of a structural column or another positive reference point.

B. Upon final approval of data, distribute copies to all trades, Owner, Architect, health department, etc. as required.

C. Drawings shall be at 1/4" scale or larger and indicate each electrical and mechanical roughing-in required for all new and/or relocated or future or purveyor supplied (the Owner shall provide proper data on purveyor supplied equipment) food service equipment as listed in the plans or specifications. Include all electrical and convenience outlets, gas, water, steam, ventilation, drains, floor depressions, wall openings, weights, ceiling recess or access panels, sleeves, beverage lines, roof data, refrigeration, etc.

D. Furnish all necessary assistance to the various trades and be responsible for the proper location of sleeves and conduits through which the utility lines are to be drawn. A field inspection shall be made before the finished floors are laid to make any necessary relocations of the utility sleeves, rough-ins and conduits, and immediate written notice shall be provided if rough in problems have occurred.

1.7 SUBMITTALS OF SHOP DRAWINGS:

A. Completely detail and submit shop drawings (s.s. fabrication, fire protection, ventilation, plastic laminate fabrication, walk ins, sneeze guards, cafeteria serving counters, hoods,etc.) in electronic PDF format showing all items to be provided under this section of the specifications. Drawings to be submitted for review at 1/2" per foot scale or larger. Upon final review of data, distribute copies to all trades, Owner, Architect, etc. as required.

B. The drawings shall show all elevations, sections, dimensions, mechanical and electrical requirements, related details of construction, installation and related work which require cutting, close fitting, etc. as required for installation.

C. Submit proper notifications in writing of any departures from the contract drawings or specifications which may be necessary to permit installation of the equipment. Fabrication should not be started until after final approvals are received and final field measurements are taken.

1.8 MAINTENANCE MANUALS

A. At time of demonstration, provide to the person in charge of the kitchen a minimum of three bound current copies of kitchen plans, roughing-in drawings, any and all warranties, instructions, parts lists, operating instructions for each piece of mechanical equipment, as built shop drawings, and "Buy-Out" brochures.

B. Manuals shall include a typewritten list in the front of the manual listing the names, addresses, and telephone numbers of local servicing agencies and manufacturer's representatives for all equipment.

1.9 SAMPLES

A. Submit all required samples for approval, if required, of all hardware, plastic laminate, paint, etc. before starting fabrication. Other samples shall be supplied as required.

1.10 MEASUREMENTS

A. Measurements required to size and place the food service equipment shall not be taken from drawings but shall be made at the structure from the actual spaces reserved therefore, and giving due consideration to any architectural, structural or mechanical discrepancies that may occur during construction of the building. Verify size of all of Owners equipment and small wares (dishes, trays, pans, etc.) and Purveyor supplied equipment (urns, soda systems, beverage dispensers, etc.), if applicable. Field dimensions shall be taken at the earliest opportunity so as not to delay deliveries.

A. Verify in field any and all measurements before doing any work on equipment that may be affected by the physical conditions and be responsible for the correction of same.

B. Inspect equipment for proper operation prior to relocation. Advise if equipment is defective or needs rework which is not included in the original contract and submit a written quotation for said work.

C. Coordinate Owners and/or Purveyor supplied equipment (coffee makers, beverage equipment, cash registers, soda equipment, etc.) as required for rough-in data, installation, etc.

D. Measurements for tight fitting equipment shall allow no more than 1/4" between wall and equipment that shall be trimmed and/or sealed as required.

1.11 WARRANTY

A. Provide a written warranty for all equipment against defects in workmanship and material for one (1) year from date of substantial completion and acceptance, excluding refrigeration units which shall carry an additional four-year warranty and a ten-year warranty on all walk-in panels. This shall cover any replacements and/or repair costs of such defective material, including transportation, labor, and materials for all equipment. This one-year free service, warranty and guarantee shall be available within 24 hours of notification on all equipment except refrigeration.

B. Provide one-year free service, warranty and guarantee within 12 hours of notification on walkIn refrigeration and units must be operational within 24 hours after service call.

C. This warranty is not intended to cover equipment which has been overly abused or items that have not had proper periodic maintenance (door gaskets, uncleaned refrigeration condensers, etc.) during the one-year period.

1.12 DELIVERY AND STORAGE

A. Furnish all labor, material, equipment, etc. as required to unload and store all equipment.

B. No equipment shall be delivered to the site unless it has been ascertained that storage space is available.

C. Make all arrangements to deliver, unload, and store all equipment and shall assume all responsibility for safeguarding the equipment until it is accepted by the Owner.

D. Unless noted in the item specifications, remove and store any existing and/or relocated equipment that is removed from the kitchen during the construction period.

PART 2 - GENERAL SPECIFICATIONS - PRODUCTS

2.1 MANUFACTURER'S STANDARDS

A. It is the intention of these specifications to provide a type of equipment conforming to manufacturer's standards and only minor variations in construction will be accepted, provided that these variations do not detract from the finished appearance, durability, general function or in any way affect general overall size, capacity, strength, etc. of equipment.

B. Manufacturer's catalog designation of material and/or fabricated equipment used in the following specifications are intended to illustrate and represent the standards which will be required by the owner. Equipment furnished must closely conform thereto in design, construction, capacity, and function to make and model called for. Where such catalog designations are given, the items shall be complete as described and shown in the catalog unless exceptions are in itemized specifications.

C. When more than one manufacturer is listed in the Item Specification, only one manufacturer shall be acceptable for items of a similar nature (fabrication, cooking equipment, refrigerators, shelving, carts, etc.) to insure uniformity of design, installation, service, etc.

2.2 FABRICATION STANDARDS

A. Unless noted under itemized specifications or on plans, the following specifications shall govern the construction of all fabricated and buyout equipment and installation and shall apply to the individual item as if it were written therein in its entirety.

2.3 FABRICATED EQUIPMENT

A. It is required that all custom fabricated items (counters, tables, sinks, dish tables, etc.) described in the plans and specifications, other than by name and catalog number, be constructed of 300 series stainless steel and be manufactured by one fabricator (Metal-Masters Inc, Advance Tabco Co., Kevry Co., Midwest Stainless, SSP Co., LTI Co., John Boos, Keystone Co., Titan Co. and McCallum Co. are approved

fabricators) with the plant, personnel and engineering facilities to properly design, detail, and manufacture high quality kitchen equipment.

B. All work in the above category shall be standard unit assembly, by one foodservice equipment manufacturer of uniform design, material and finish.

2.4 BACKSPLASHES

A. Where edges of the top are adjacent to walls, column, equipment or enclosures, they shall be turned up to provide a backsplash which shall be tight fitting (1/4" or less). Unless noted, all backsplashes shall be formed by turning up 10" and flanged back 2-1/2" at 45 degrees and down 1" and attach to wall with 6" by 2" s.s. "Z" clips on 3'-0" centers. Ends of backsplash shall be fitted with closure plates. Weld a full s.s. enclosure panel for exposed rear backsplash.

B. Tops adjacent to refrigerators, ovens or cabinets shall be turned up 4" with top edges feathered slightly to form a tight fit of 1/4" or less. Seal with mastic compound.

2.5 BOLTS, SCREWS AND RIVETS

A. All exposed surfaces of equipment shall be free of bolt, screw and rivet heads. Wherever bolts are used to fasten tops and trim to paneling, body of counters and similar equipment, such bolts shall be of an approved type and shall be corrosion resistant metal of the same alloy as the metal to which they are fastened with acorn type nuts to eliminate sharp edges.

2.6 CASTERS

A. Provide heavy duty casters with double ball bearing raceways, heavy gauge fork and races and have minimum capacity of 250 pounds per caster. Casters shall be provided with brakes. Wheel shall be non-marking urethane.

2.7 CODES AND SANITATION

A. All food service equipment under this contract shall meet the requirements and bear the label of the National Sanitation Foundation. Specifications set forth are considered minimum and are to be superseded by any superior requirements in effect as of this date by the National Sanitation Foundation or the State Health Department. Any differences of opinion on sanitation shall be referred to the State Health Department for arbitration.

2.8 CORNERS

A. All corners shall be fully rounded and made integral and of the same sheet as the top and rolled edges. Radii of all rolled edges to be equal and rolled 2" diameter at least 180 degrees. Filler pieces or soldering shall not be used in place of all welded, seamless construction.

2.9 CUTTING BOARDS

A. Provide Read Products or Mapletex Co. 1/2" minimum thick reversible boards as per plan as manufactured by Read Products Inc. when attached to grills or similar equipment, provide s.s. mounting brackets.

2.10 DISHTABLES

A. Provide NSF approved series SC-DT dish tables with 14 gauge 304 s.s. coved corner construction as manufactured by Metal-masters Co. or equal with 10" backsplash as previously specified where adjacent to walls and remainder of tables to have 3" high roll rim and be mounted on 12 gauge under-channeling, 16 gauge s.s. cross rails and legs with s.s. gussets and s.s. adjustable bullet feet and/or flange type feet. Tops shall be pitched to dishwasher to avoid standing water and undersides shall have sound deadening material and be attached to walls with s.s. "Z" clips.

B. Provide removable 18 gauge s.s. under-shelving which has 2" rolled up edges at rear and roll down edge at front and be supported on s.s. cross rails on all sides. Notch all corners to fit legs and piping. Under-shelving shall not interfere with booster heater or adjacent equipment.

C. Provide s.s. recessed drain trough with drainer in all soiled dish tables. Unit shall not interfere with dishwasher control panels or adjacent equipment.

D. Disposer cones and/or scrapping trough shall be integrally welded into top and also provide s.s. brackets for switch and holes in backsplash return for vacuum breaker. Trough shall be size and shape as per plan by 6" deep with coved corner construction and sloped to disposer. Provide 20" long s.s. pan formed removable trough covers. Provide T&S Co. 2905 water inlet at shallow end of trough and every 3'-0" and at change in directions. Inlets shall be controlled by a 2600 mixing valve mounted on a s.s. bracket mounted under dish table and be interconnected to water line and solenoid so water flows thru inlets when disposer in operation.

E. Provide integral s.s. pass thru sill extending thru wall as per plans and specifications with flat side splashes and turn down front with closed ends. Provide 1" rear turndown at table at 30 degrees so sill is higher than dish table. Provide wood bracing on sill as required for support. Verify requirements of roll up door by prior to installation of tables.

F. Provide raised roll rim in lieu of 3" high roll rim at front edge of soiled dish table when used as a pass thru dish deposit area.

2.11 DOORS:

A. SLIDING DOORS - Sliding doors shall be constructed of 16 gauge s.s. or material listed in the item specifications with roller bearing slides.

B. SINGLE PAN - Construction, 16 gauge s.s. with 3/4" thick sound deadening fiberglass between the two thicknesses of metal. Back panel to be 20 gauge steel. Door to operate on top hung ball bearing rollers. Bottom edge of doors to be square and fitted with a groove that rides over a s.s. pin at center point.

C. All doors shall be fitted with stops and locks. Handles shall be die stamped s.s. flush mounted.

D. HINGED DOORS - All hinged doors for cabinet bodies and enclosed bases shall be double pan construction. Doors shall be flush mounted and be fitted with s.s. piano type full length hinges. They shall be furnished

with friction catch and s.s. recessed handles, locks, and two rubber button noise eliminators, one at each corner on handle side.

2.12 DRAWERS:

A. All drawer inserts shall be coved corner die stamped out of one piece of 18 gauge s.s. or plastic and shall set loosely in a channel frame so it can be lifted out for cleaning. Top edges are to be flanged out 1/2".

B. The supporting frame shall be welded steel channel with s.s. drawer face welded to frame so there will be no exposed screws or rivets on the face which shall extend 3/4" out at top and down 3/4" with 1/2" hemmed edge and radius corners to form drawer handle. Provide two rubber button shock stop noise eliminators one on each side of the drawer face at the top.

C. Provide heavy duty s.s. drawer slides with heavy duty s.s. ball bearing wheels. Slides and frame to be so designed as to allow full opening of drawer and to be reinforced to support 150 lbs. when fully extended.

D. Adjustable stops are to be provided for each drawer at the fully open position. Drawers on open base tables shall be enclosed in an 18 gauge housing of steel. Drawer guides are to be sloped to provide self-closing action.

E. All drawers shall be 20" by 20" by 5" deep.

2.13 ENCLOSED BASE CABINETS:

A. All enclosed bases or cabinet bodies shall be similar to Delfield Company or equal Mark VII series and constructed with 14 gauge s.s. tops and 18 gauge s.s. bodies and be enclosed on the ends and sides. The bases and bottom shelves shall be reinforced with channels and angle bracing and gussets as required. Additional angles and channel cross members shall be provided to reinforce shelves and support tops as required for counter top equipment (urn, ice dispensers, drink dispensers, etc.) as shown on plan.

B. All free corners of enclosed bases or cabinet bodies shall be rounded on a 5/8" radius and all corners against walls and other fixtures shall be square. In the case of fixtures fitting against or between walls, the bodies shall be set 1" from the wall line, but the tops will extend back to the wall line to permit space for rough-ins and adjustment to the wall irregularities. The ends of the cabinet bodies shall extend to the wall line and be sealed and/or trimmed as required.

C. These fixtures shall be constructed with 6" s.s. adjustable legs, unless set on masonry or steel bases as called for in the itemized specifications.

2.14 FIELD JOINTS:

A. All field joints shall be welded with rod of same basic composition as sheets or parts welded. Welds shall be free of pits, cracks, cross graining or discolorations and shall be ground and polished to the original finish of the metal. No soldered or bolted joints shall be used unless noted in item specifications and shall be properly sealed and bolted.

2.15 GRINDING AND POLISHING:

A. All exposed welded joints shall be ground flush with the adjoining material and neatly finished to harmonize therewith. Services shall be free of depressions. Wherever sheared edges occur, they shall be free of burrs, projections and fins to eliminate all danger of cutting or laceration when the hand is drawn over such sheared edges. Where miters or bull nosed corners occur, they shall be neatly ground to a uniform condition, and in no case will overlapping material be acceptable. All exposed surfaces shall be satin finish except rim which shall be a highly polished and buffed finish. Satin finish shall be comparable to the commercial mill finish known as No. 4 for s.s. No cross graining on equipment is acceptable.

2.16 GUARDS

A. All machines shall be furnished fully enclosed with guards built in accordance with safety codes and regulations of State or Governmental agency having jurisdiction.

2.17 HOT FOOD WELLS:

A. Provide insulated food wells with coved corner s.s. interior and the electrical element attached to the underside of well. When units are specified with drains, the manufacturer shall provide a drain assembly with bushing and a universal joint as required to manifold and interconnect all wells with a master and individual valves and Drain handles shall be easily accessible from employee side of counter. All wells shall be inter-wired to master switch with indicator light. Provide galvanized access panel below wells to protect wiring. Units shall be heated by 208/240 volt 1200 watt electric elements with thermostatic control with guard ring and pilot light or 3600 BTU gas burner with individual control and removable heavy steel radiant plate set above heating device.

2.1 INTERIOR SHELVES:

A. All interior shelves in cabinet bodies and enclosed bases shall be 18 gauge s.s. or as called for in the itemized specifications. Turn up on back and ends of shelf shall be 1-1/2" high and coved on 3/4" radius. The front edge shall be turned down 1-1/2" and back 1/2". All shelves shall be rigidly reinforced below to prevent sagging. Provide ferruled cutouts in shelves for drain lines, conduits, etc.

2.2 LEGS - FEET - FRAMES:

A. All legs and pipe stands for open base tables, dish tables, etc. shall be constructed of 16 gauge s.s. tubing unless noted, with cross rails and braces of the same materials. All joints between legs, under-shelves and cross braces are to be welded and ground smooth.

B. Cross rails must be supplied to reinforce each leg. Legs anchored to gussets at top only and without cross rails are not acceptable. Pipe stands and frames furnished on all pipe base fixtures shall have legs of 1-5/8" O.D. 16 gauge s.s. tubing, cross rails of 1" O.D. 16 gauge s.s. tubing unless noted.

C. Top of stand shall be fitted into s.s. gussets welded to reinforcing structure on underside of the table top, spaced not over 3"-6" on centers.

D. All legs shall be fitted with adjustable s.s. bullet shaped feet with bottom of pipe legs to be finished off smoothly and overlap the stem to provide sanitary fitting and prevent the accumulation of grease or other debris at this joint. Provide s.s. flange type feet securely anchored for island style counters, sinks, etc.

E. All pipe legs or vertical members are to be set back from edge of table tops a sufficient distance to offset any interference with workers, walls, columns or other equipment.

F. Provide 6" adjustable legs with adjustable s.s. bullet foot for fabricated and/or buyout equipment with minimum capacity of 1500 pounds each.

2.3 MATERIALS AND STRUCTURAL SHAPES:

A. Angles, bars, channels, piping, pipe legs, etc. used shall be uniformly ductile in quality and free of hard spots, runs, checks, and other surface defects. Except as otherwise specified, all such sections shall be milled steel galvanized by the hot dip process, all free of runs and blisters, uncoated spots or patches. S.S. shall be 18-8 composition (302 alloy) standard with No. 4 finish and polished to 180 grit and welded as previously specified. Provide butyl sealant sound deadening between tops and all structural supports or as required.

2.4 NAME PLATES

A. Each item of equipment shall have a corrosion resistant metal name plate with model number, serial number, name and address of the manufacturer securely fastened to equipment in a non- conspicuous area. All mechanical and electrical controls, switches, disconnects, remote compressors, etc. shall be labelled with metal or engraved phenolic plastic signage.

2.5 OVERSHELVES AND WALL SHELVES:

A. Provide 10" wide NSF 16 gauge s.s. over-shelves or wall shelves unless noted in the plans or item specifications. Provide wall mounted shelves with rear and sides to be turned up square 1" and front edge to have sanitary roll rim. Provide heavy gauge s.s. wall mounting brackets 6" from ends of shelf with maximum of 4'-0" on centers.

B. Provide all over-shelves with sanitary rolled edges and bull nose corners on all four sides unless equipment is mounted on shelf (microwave, toaster, dishes, etc.) and provide 1/2" turn up at rear for that portion of the over-shelf. Provide s.s. tubular support standards as required for shelf mounted equipment and with provisions for mounting to table or counter top.

C. Provide all wall backing and/or structural support as required for shelves to support 50 pounds per square foot and coordinate installation of same with trades.

2.6 PAINTING

A. All galvanized material and black steel shall be thoroughly cleansed of all oil and foreign matter and given two (2) coats of enamel paint as selected.

2.7 ROLLED RIMS AND EDGES

A. Standard roll rim shall be coved up 3" with 1/2" diameter roll at 180 degrees and bullnose corners.

B. Square edge shall be turned down 2" at 90 degrees with 3/4" tight hem at bottom.

C. Marine edge shall be turned up 1/2" on a 45 degree angle and turned down 2" with 3/4" tight hem at bottom.

D. Wherever table tops are used in connection with sinks, the top shall be fabricated with a 1/2" high raised roll rim spillage edge unless otherwise specified. Top to be integrally raised approximately 1/2" at all edges and then rolled down 2" at 210 degrees with bull nose corners.

2.8 REINFORCED STRUCTURES:

A. Counter, table, and cabinet framework shall be constructed of steel angles horizontally and channels vertically, made in sections to permit assembly on job with tops field welded. Vertical fronts and sides of cafeteria counters and similar enclosures are to be reinforced with channels on approximately 3'-0" centers to support the tray slide brackets.

B. Unless otherwise specified, angles or channel frames and similar cross bracing on not over 2'-0" centers to be provided under all counter and table tops to stiffen tops and furnish fastening supports for leg flanges.

2.9 SINKS:

A. Provide 14 gauge s.s. coved corner sink bowls integrally welded as per plan with welded seamless construction with scored bottom towards a die stamped drain outlet with a Fisher lever handle waste and connected overflow located 1" below drain board and shall not interfere with plumbing, adjacent walls, equipment, etc. Provide 14 gauge s.s. bracket for drain stem. All multiple compartment sinks shall be double walled construction. When sinks are built into enclosed base counters, provide access holes for lever waste handle stem.

2.10 TABLE TOPS:

A. METAL - Metal table tops to be 34" high and be constructed of 14 gauge 302 s.s. with NSF roll rim construction and bull nose corners unless otherwise noted. All seams and coved corners shall be welded, ground smooth and polished. Provide ferruled access holes for cutouts for water lines, cords and plugs, etc. as required in table tops, counter tops, urn stands, etc. All open base tables shall be reinforced with 12 gauge angles or channels. Provide welded cross angle or channel members shall be placed at each pair of legs with gussets, welded cross rails and feet as previously specified.

B. One angle runner, running lengthwise shall be provided on tops up to 30" wide; two provided on tops over 30" wide. All tops shall be reinforced so that there will be no noticeable deflection and all reinforcements shall be stud welded to the underside of the top. No rivets or bolts to be used through the top. Provide sound deadening material between tops and reinforcing members and underside of tops. Field joints are to be provided in the top where necessary.

C. RICHLITE – Read Products or Mapletex or plastic tops shall be NSF construction with 1" thick top with drop edge supported on 12 gauge framing and top reinforcement channels attached to legs as above. Provide 6" coved riser at rear and sides when specified. When drawers are specified below tops, 12 gauge

reinforcement channels shall be provide for mounting of drawers or for tables with removable tops. If Read Products or Maple-Tex top tables are used as bake table, verify location and size of ingredient bins located below drawers to assure proper fit.

2.11 UNDERSHELVES:

A. The under-shelves on open base tables, dish tables, etc. shall be a solid removable 16 gauge s.s. shelf unless noted in the itemized specifications. Shelf is to be turned up at rear and down on all front and side (down on all island units) edges 1-1/2" with corners at legs cut out and mounted on the support stringers on all four sides. Provide ferruled access holes as required for drain lines, water lines, conduits, etc.

2.12 VENTILATION-HOODS-DUCTWORK

A. Unless otherwise stated in the item specifications, provide 300 series 18 gauge s.s hoods similar to Captive Air Co. or Duo Aire Co. or Accurex Co. and be manufactured in accordance with and bear the seal of NSF, UL, and NFPA 96. Hoods shall be mounted 6'-8" above finished floor and must overhang all equipment by a minimum of 6" at front (18" for drawer type broilers) and sides and be furnished with a full complement of s.s. UL filters, filter frame with grease cup, recessed LED lights inter-wired to junction box on top of hood and to switch on face of hood, duct collars, fire dampers, hangers, hemmed 18 gauge s.s. end panels, s.s. closure panels from top of hood to ceiling, cutouts and trim for power distribution system or columns, etc. Provide insulated NFPA integral 3" stand-off behind hood when installed on non-rated wall. Walls for hood mounting shall be rated as required by code.

B. All exhaust fans shall be UL-762 rated vertical discharge fans with insulated curb, hinged base with grease collection device, mounted and inter-wired starter and disconnect, adjustable drive assembly and be sized for CFM as per plans with a sound classification of "average" and not to exceed 12 sones.

A. All makeup air units shall be sized for CFM as per plan. Unit shall be fully factory built with supply fan, filter section with bird screen, motorized inlet dampers, metal cabinet with weather proof epoxy coated finish in color as selected by Owner, 12" legs and rails, curb, vibration eliminators, factory wired control panel and disconnect with wiring harness and pigtails for interlock of exhaust fan and make-up air unit to switch panel on face of hood or remotely located. If required by code provide a pre-heat section (gas, electric, steam or hot water) which shall provide a minimum degree rise capability (as shown in item specifications and/or as required by local code) complete with full modulating controls, thermostat, etc. as required for a complete system. Provide all UL listed components.

B. All ductwork shall be constructed and installed as per SMACNA minimum gauges and requirements. Make-up air ductwork shall be insulated and of rigid metal construction. Flex duct will not be allowed. Provide welded 16 gauge black iron exhaust ductwork as per code requirements and conform to all building requirements and obstructions with all dimensions subject to verification in field. Provide all ductwork with cleanouts every 6'-0" of horizontal run (with pitch as per code) and at changes in direction, access panel, dampers, curbs, flashing, flanges, plenums, supports, insulation, etc. as required by code and to provide a watertight system. Fire rating shall be provided as noted on the food service plans and in the item specifications.

C. System is to be factory tested and balanced as required for proper operation with written report to Architect and Owner.

D. Roof openings, structural support, fire proofing, and final connections shall be provided as outline in the Construction manager scope of work.

E. If required by code, cooking exhaust hoods shall have an Ansul Co. R-102 or equal chemical fire protection system and will be listed separately in the specifications.

2.13 WALK INS AND REFRIGERATION

A. Provide NSF and UL approved walk ins as per the item specifications size and shape as per plan by 8'-6" high and furnished with prefabricated modular construction tongue and groove cam lock style panels for walls with coved vinyl screed, ceilings, and floors with 4" foamed in place UL-25 flame spread class No. 1 urethane insulation with a minimum "R" factor of 32 and a "K" factor of 0.121. Wall and ceiling panels shall have 0.040 stucco embossed aluminum or 20 gauge 304 s.s. finish and floor panels shall be 0.100 smooth aluminum or 18 gauge s.s. with a rating of 700 pounds per square foot with non-skid floor strips. All panels shall have a ten-year guarantee and be installed with a watertight seal. Provide 4" s.s. high coved base molding at all exposed exterior and interior walls securely anchored and sealed as required. Provide ceiling hangers and structural supports as required.

B. If floorless construction is required refer to the Construction Manager scope of work. Provide 4" urethane insulation and vapor barriers for sub floor and tile floor. Provide coved floor screeds below wall panels anchored to red wood vapor barriers which shall extend up thru and 1/8” above the level of the finished floor, 6 mil polyethylene vapor barrier, etc. as per the manufacturers standard requirements. Supply and coordinate installation of walk-ins to assure proper fit of floor recesses, sizes, tile, insulation, grout, vapor barriers, drainage, etc.

C. Provide one surface mounted LED light fixture mounted above door for the first 50 square feet of floor space and one additional ceiling mounted fixture as shown on the plans. Lighting shall provide a minimum of 35 foot candles at 36" above floor. The light above door shall be inter-wired to switch and junction box, but all additional lights shall be installed and wired in field with conduit located outside the compartments.

D. Provide 36" by 78" in-fitting doors with magnetic gaskets, three C.P. cam lift hinges, s.s. front, 24" high interior aluminum tread plate kick plate, cylinder locks, and automatic door closer. Doors shall be mounted in reinforced panel with FRP or s.s. door jambs with thermal break and thermostatically controlled heater strip, s.s. heavy gauge heated threshold, safety release, digital thermometer, and virgin plastic full width door curtains mounted 6" above door header. Provide non heated relief air vents for cooler and inter-wired heated vents for all freezer compartments mounted above doors.

E. Provide removable closure trim with concealed fasteners of same appearance as walk-in exterior from box to all adjacent building walls and ceilings. Provide access panels and louvers as required for service.

F. Refrigeration systems shall be complete with items as specified or as required to provide a first class system. Should any dispute arise as to the quality of equipment or workmanship, the decision shall rest with the Consultant.

G. Hermetic or scroll compressors shall be mounted on anti-noise, anti-vibration blocks, and be factory mounted in welded angle iron frame and housing with support rails, metal curbs, timed defrost, factory installed control panel, pilot light, NEMA rated disconnects and starter, etc. Compressors to be factory pre-connected for final water and electrical connections. Verify that proper ventilation of compressors is obtained.

H. Provide coil and/or compressor condensate drain lines as required and shown on the drawings. Provide drain lines terminating with trap over floor drain where shown. Drain lines to be neatly insulated with material similar to Armaflex. Any drain line run through a freezer compartment shall also have a heater coil neatly wrapped over the line, prewired and shall operate continuously. No drain piping shall interfere with shelving

within the compartment nor exit through the front of a compartment. All piping shall be concealed where possible.

I. Coils shall have timed defrost and immersion type thermostat and be connected to compressors by equipment supplier using type "L" copper tubing soldered using industry acceptable refrigerant. Refrigeration lines shall be insulated in same manner and materials as coil and drain lines and shall be concealed where possible.

J. Provide refrigeration system with expansion valves, pressure controls, strainers, solenoid valves, liquid dryers, adjustable room thermostats, hangers, king and queen valves, heat exchangers, oil separators, pump-down solenoid, low ambient controls, crankcase heater, outdoor shroud, shut-off valves, sleeves, sight glass with moisture indicator and all other items necessary for a complete system.

K. All electrical components within each compartment shall be pre-wired by supplier to junction box on exterior top of compartment. Make final connections and inter-wire to lights and from walk-in coils to compressor for timed defrost in conduit as required.

L. After final connections, evacuate, pressure test, charge, start up and operate system for a period of three (3) days and make all necessary adjustment of controls as required. Operate coolers at 35 degrees and freezers at -5 degrees unless noted on plans. Provide manufacturers five-year compressor warranties and one-year free service available within 12 hour notification.

2.14 WATER INLETS:

A. Water inlet locations shall be located above positive water level to prevent syphoning of liquid into the water system.

B. Wherever conditions require water inlet placed below water level, a suitable pressure type syphon breaker or double check valve shall be placed on fixture to form a part of same to prevent back syphoning.

C. Exposed syphon breakers shall be chrome plated units with chrome plated piping and slip flanges where exposed.

2.15 MECHANICAL/ELECTRICAL MATERIALS REQUIRED IN FOOD SERVICE CONTRACT:

A. The equipment supplier shall include materials properly labelled and packaged as follows:

B. PLUMBING APPURTENANCES:

1. Check requirements for gas, water, steam, etc. on job before ordering equipment. Information shown on drawings or specifications does not relieve contractor of this responsibility.
2. Faucets, pre-rinse units, lever wastes, vacuum breakers, to be as manufactured as described in the item specifications.
3. Except as otherwise specified, provide each sink compartment with deck type or backsplash type faucet with minimum 12" swing spout soft flow. Where multiple sink compartments are provided, faucets may be located between compartments.
4. C.P. brass overflow fittings shall be 1-1/2" tubing fully connected to sinks at factory with lever handle quick opening wastes with tailpieces on each sink compartment.

5. Provide all solenoids, C.P. atmospheric or pressure type vacuum breakers with C.P. stems above counter tops, shock absorbers, check valves, mixing valves, gas regulators, etc. required by code or for proper operation of equipment with mounting brackets as required. Valves shall be installed where required, accessible and convenient to the operator.
6. Provide swivel gas hoses assemblies 36" or of proper length as required with quick disconnect, ball valve, caster floor locks and 3000 pound coiled restraining device, and wall brackets.
7. All steam equipment shall have valves provided with heat resistant handles, traps, gauges, etc. as required for proper operation

C. ELECTRICAL APPURTENANCES:

1. Check voltage on job before ordering equipment. Information shown on drawings or specifications does not relieve contractors of this responsibility.
2. Except where noted under item specifications, current characteristics for motors 3/4 HP or less, solenoid valves and lighting shall be 120 volt, single phase, 60 cycle, A.C. Unless otherwise noted under item specifications, motors 3/4 HP and over shall be wound for 208/240 volts, three phase, 60 cycle, A.C.
3. Provide 120 volt control circuit on all equipment that operates on voltages on or over 208 volt. All equipment requiring 120 volt control circuits (120/480 volt, 120/208 volt, etc.) shall have transformers pre-wired on equipment.
4. Cords and plugs and receptacles for equipment shall be three or four wire all rubber coiled retractable style cord with ground as required and match receptacles provided and as best suited for the equipment. Units shall be mounted in NEMA type enclosures as per code with s.s. faceplates and boxes where receptacles are exposed.
5. Thermostats, unless otherwise noted on plans or in the item specifications, shall be provided at all equipment (bain-marie, urns, dish machines, hot food table, warming cabinets, etc.) with thermostatic control.
6. Heating elements to be of voltage and phase as specified or as required to suit job.
7. Controls, thermostats, switches, contactors, low water cut off, light fixtures and bulbs, etc., necessary for the installation and proper operation of equipment shall be furnished as required along with all starters and/or motor control switches for the proper function of the equipment specified. Controls mounted on vertical surfaces shall be recessed.
8. Controls that are an integral part of equipment shall be factory installed. Controls which are to be separately mounted shall be shipped loose for field installation. Coordinate all field installation so as to not interfere with access and/or operation.
9. Provide properly sized magnetic starters line voltage type with thermal overload relays and reset for normal operation by automatic control or pushbutton station for 208/240 volt control. Enclosures shall be general purpose NEMA type 1, A.C. voltage, unless located outdoors which will require a waterproof enclosure. Remote control motors shall have magnetic starters.
10. Disconnect switches shall be type non-fusible, single throw, heavy duty industrial, quick make, quick break. Circuit breakers may be used in lieu of above disconnects as per code.
11. Provide equipment with required internal wiring between elements, switches, motors, receptacles, starters, etc. complete to a junction box. Disconnect, starter, etc. as required and are to be “left ready” for final connections. All control circuits shall be 120 volt to ground.

PART 3 - GENERAL SPECIFICATIONS - EXECUTION

3.1 INSTALLATION AND MATERIALS:

A. All work required under this section shall be installed by the proper trades having jurisdiction in this area concurrent with job progress, Construction manager scope of work and related field conditions. Such installation shall be under the direction of a competent supervisor. A site inspection is recommended prior to bidding if applicable.

B. Provide for the conveyance, uncrating, erection, assembling, setting in place, trim, cutting of holes and ferrules in equipment for piping, drains, electrical outlets, etc.

C. Coordinate installation with all trades, repairing of any damage done to equipment during installation, removal of debris created by installation, startup, testing, and cleaning of all equipment (new, existing, or relocated).

D. Where necessary to move equipment to make final connections, coordinate and assist all in moving equipment and be on the job to carefully level and adjust equipment as the connections are being made. During installation, coordinate with all trades on connection details and be responsible for meeting the individual equipment manufacturer's connection requirements. Report any infractions of installation procedure in written form.

E. The fit of all equipment as it joins all walls, floors, and corners shall be tight (within 1/4") to adjacent walls, seal all equipment with NSF approved clear sealing compound and/or s.s. trim molding of proper size with concealed fasteners. Inspect the site and advise in writing and/or on shop drawings all necessary building requirements door sizes, etc. to receive the equipment and assure accuracy of fit and installation.

F. All cabinet bases and pieces of equipment which are to be set on bases or machine platforms shall be set into a sealing compound of color to match the tile mortar. Enclosures, backsplashes, and turn-backs to wall shall be pressed into a ribbon of the same material with the excess wiped out to a radius fillet. Where necessary, and to eliminate shifting and the subsequent breaking of this seal, item shall be anchored to floor and wall with suitable masonry anchors. All equipment with utility connections (island style sinks, dish tables, etc.) shall also be anchored to floor with s.s. flange type feet.

G. All equipment and materials shall be new, of prime quality, full gauge thickness of compositions indicated by names or abbreviations stated in itemized specifications.

H. Equipment batteries of one manufacturer are to be pre-fitted at the factory and provide photographic proof of such work.

I. If equipment is noted as relocated or removed during the construction period, said equipment shall be disconnected and be re-connected as directed in the Construction Manager scope of work and removed and stored unless noted in the item specifications. Coordinate and supervise this work and label equipment for reuse. Reinstall and clean equipment as per the plans and specifications. Existing equipment not scheduled for reuse shall be removed as directed in the Construction Manager scope of work.

3.2 LIMIT OF OTHER SUBCONTRACTORS/TRADES RESPONSIBILITY:

A. Hood Connections:

Note that kitchen grease and/or dishwasher hoods and ducts may or may not be furnished as part of this contract. Refer to the plans and item specifications. Make connections to hood and connect to exhaust fan and make up air unit as directed in the Construction Manager scope of work. All ductwork shall have welded and/or watertight joints. All roof holes, flashing, structural support, fire rating, and final connections are to be provided as directed in the Construction Manager scope of work.

B. Plumbing:

1. Provide rough-ins and piping with stop valves, elbows, nipples, couplers, traps, waste vents, gas regulators, for water, steam, gas, etc. and make final connections to the equipment as directed in the Construction Manager scope of work.
2. Install equipment accessories (faucets, lever wastes, solenoids, valves, gas hoses, nipples, etc.) as directed in the Construction Manager scope of work.
3. Provide water heater and janitors sink unless otherwise indicated on the plans as directed in the Construction Manager scope of work.
4. Disconnect and reconnect relocated equipment if applicable as directed in the Construction Manager scope of work.

C. Electrical:

1. Provide rough-ins, controls, panels, switches, wall receptacles to match equipment cords and plugs, starters, junction boxes, canopy light and fan switches, conduit, wiring, wall outlets, disconnects, etc. and make final connections to the equipment as directed in the Construction Manager scope of work.
2. Install equipment accessories (cords, wiring harness, switches, etc.) in conduit as required by code as directed in the Construction Manager scope of work.
3. Disconnect and reconnect relocated equipment as directed in the Construction Manager scope of work.

D. General:

1. All concrete platforms, bases, etc. will be provided as directed in the Construction Manager scope of work. Grouting of drip pans and/or floor troughs to be installed as directed in the Construction Manager scope of work.
2. All required holes and recesses for piping and ducts will be coordinated with all trades and as directed in the Construction Manager scope of work. Provide location, size, etc. This information is to be provided in adequate time to be incorporated in the work.
3. Unless stated in the item specifications, provide all floor recesses, insulated sub floors, tile floors and vapor barriers for walk-ins as noted in the plans and as directed in the Construction Manager scope of work.
4. If applicable, remove relocated equipment from kitchen and store in adjacent area during Kitchen construction period. Coordinate removal, inspection, storage, labeling, etc. of equipment. Reinstall relocated equipment as per plan after construction is completed as directed in the Construction Manager scope of work.
5. Provide fire rated walls in kitchen for cooking equipment exhaust hoods and non-combustible materials within 18" of top of hood or as required by fire codes as directed in the Construction Manager scope of work.

3.3 TESTING:

A. After installation and hook, inspect, start up, clean, adjust and test all equipment under operating conditions for 48 hours prior to acceptance by Owner. If inspection or test shows defects, such defects shall be corrected and inspection and test repeated. Certify in writing that all equipment is performing in full compliance with the plans and specifications.

3.4 DEMONSTRATION:

A. After utility connections to the equipment is completed, schedule and conduct the inspection and start up and final test of equipment prior to final inspection. Schedule the demonstration with the Owner and perform the demonstration in the presence of the Owner and/or their authorized representative with a minimum of seven days notification to owner.

B. Before final inspection, remove any and all protective covering from his work and give all parts of all equipment a thorough cleaning and servicing, leaving items free from defects and remove trash from premises.

C. Provide required competent personnel for two eight-hour periods as instructors to operating and maintenance personnel on the safe and proper operation and maintenance of all equipment. Provide additional instructions up to eight additional hours during the one-year guarantee period as requested by the Owner.

D. Present all maintenance manuals and as built drawings as previously specified or requested by Consultant.

3.5 FINAL INSPECTION AND PUNCH LIST:

A. After installation is completed and tested, notify the Consultant who will review all equipment and submit a repair or punch list of all items that are not in compliance with the documents. All items shall be completed immediately and not to exceed 14 days unless written notice is submitted and approved.

3.6 SCHEDULE OF EQUIPMENT:

A. The following specifications refer to items of food service equipment on the drawings which shall form a part of these specifications and are binding as written herein, and will indicate the required quantity, size, etc. of each item.

Item Specifications:

Item #101 – Walk-in Cooler & Freezer - Qty. of 1
Base Manufacturer: Kolpak Co. Base Model: R-Series
Alternate Manufacturer: Norlake Co.
Alternate Manufacturer: Bally Co.
Alternate Manufacturer: American Panel Co.
Alternate Manufacturer: Imperial/Brown Co.
Alternate Manufacturer: Tafco Co.

Minimum specifications:
1. NSF walk-in sized approximately 20’-9” by 9’-8” and shape as shown on plan by 8'-4" high with aluminum interior and stainless steel exposed exterior finish, aluminum interior ceilings, door heaters, gaskets, pressure relief port, heated door threshold, etc. for all compartments. Provide digital thermometer with audio / visual alarm system with dry contactors to connect to building management system for all compartments.
2. Trades to furnish and install insulated sub-floor and vapor barrier as shown on plans. Minimum insulation value of the floor shall be R-28.
3. Provide standard 34" wide flush mount doors with 18” by 24” heated triple pane viewport, stainless steel front, 24" high aluminum tread-plate interior kick-plate, two cam lift hinges, chrome plated hardware, and have same 4" thick foamed in place UL-25 flame spread rated urethane insulation as walls and ceiling. Provide Curtron Co. Polar Pro USDA Polar Grade self-closing hinged vinyl door curtain with .120” clear door panels and stainless-steel mounting hardware.
4. Furnish one LED light mounted over the door and extra 48” LED lights inter-wired to switch per plan. All lighting shall have a 40 lumens per watt efficacy or more including ballast loss.
5. Joints between walk-in and building walls and ceiling shall be closed with filler strips of same appearance as exterior of box with service access panels as required.
6. Provide one UL listed 208 volt 3 phase system for the cooler and one 208 volt 3 phase system for the freezer. Provide Copeland compressors piped to BTU matched Bohn low profile end mount coils. Freezer shall have 208 volt 1 phase timed electric defrost coil. Cooler shall have 120 volt air defrost coil. Both coils shall be furnished with electronically commutated motors, remote mounted (shipped loose) weather proof time clock for timed defrost, thermostat, solenoid, “P”-trap and expansion valves mounted and wired.
7. The air cooled compressors shall be factory assembled and mounted on heavy duty steel base and be placed on roof with outdoor package in aluminum housing with hinged shroud, head pressure control with flood back, crankcase heater, sight glass, frame mounted dual pressure control, oversize condenser, drier, suction line filter, suction vibration eliminator, oversize receiver with total pump down capacity and king and queen service valves. Provide a pre-wired NEMA-3 control panel with industrial grade fused disconnect, terminal block, magnetic starters, circuit breakers and contactors, defrost timer and pump down switch.
8. Provide approximately 45’-0" of field piped and pressure tested insulated refrigeration lines per compartment to connect compressors to coils. Provide refrigeration with piping, controls, drain lines and heat tape, etc.
9. Provide a five year warranty on compressors and one year free service plan as per G.S.
10. Final connections, structural support, etc. are by Trades.

Item #102 - Utility Cart - Qty. of 2
Base Manufacturer: Cambro Co. Base Model: BC2354S110
Alternate Manufacturer: Rubbermaid Co.

Minimum specifications:
1. Unit to be black polyethylene construction.
2. Three shelves.
3. Heavy duty swivel casters.
4. 500 lbs. capacity or more.

Item #103 - Shelving - Qty. of 20
Base Manufacturer: Cambro Co. Base Model: CPU-72-V4
Alternate Manufacturer: Inter-Metro Co.

Minimum specifications:
1. Provide polymer unit size and shape as per plan.
2. Units shall have 74” posts.
3. Post connectors, traverses and four vented shelf plates.
4. Two swivel and two locking casters.

Item #104 – Lockers – Not in Kitchen Equipment Contract.

Item #105 - Pan Rack - Qty. of 1
Base Manufacturer: New Age Co. Base Model: 1335
Alternate Manufacturer: Channel Co.
Alternate Manufacturer: Lakeside Co.
Alternate Manufacturer: Advance Tabco Co.

Minimum specifications:
1. Provide fully welded universal angle 64" high aluminum rack.
2. Two 5” heavy duty swivel casters and two 5” heavy duty locking swivel casters.

Item #106 - Dunnage Rack - Qty. of 2
Base Manufacturer: Inter-metro Co. Base Model: HP-PD
Alternate Manufacturer: Eagle Co.
Alternate Manufacturer: Cambro Co.

Minimum specifications:
1. Furnish and install polymer unit size and shape as per plan.
2. Connector strips.

Item #107 - Fire Protection System - Qty. of 1
Base Manufacturer: Pyro-Chem Co. Base Model: Kitchen Knight II
Alternate Manufacturer: Ansul Co.
Alternate Manufacturer: Range Guard Co.
Alternate Manufacturer: Kidde Co.
Alternate Manufacturer: Amerex Co.

Minimum specifications:
1. Furnish and install a pre-engineered wet chemical fire detection and suppression system, properly sized, to protect the hood, duct, plenum, and surface appliances. The system shall be installed in accordance with NFPA Standard 17A and 96 and meet UL 300. The installation shall also comply with all local and/or state codes and standards.
2. The cylinder and controls shall be housed in approved stainless steel cabinet and be mounted as shown on plans. The system shall be capable of both automatic and manual operation with a remote mechanical manual pull station (54" above floor) located in the path of egress, a minimum of 10 feet and a maximum of 20 feet from the hood. Provide fusible link detectors properly located and temperature rated per manufacturer’s specifications for automatic detection.
3. Provide and locate piping and required nozzles for duct, plenum, and surface appliance protection as per manufacturer’s specifications. Provide concealed piping where possible with

non-exposed piping and fittings shall be black pipe and stainless steel or chrome plated or chrome sleeved where exposed (no galvanized piping). No horizontal supply piping greater than 6 inches from a T is allowed under the hood. All hood penetrations to be accomplished by UL listed seal-tite fittings.

4. Provide a mechanical gas shut-off valve of approximately 2" - VIF. The valve shall be installed in an accessible location within 20 feet of the hood by the mechanical trades - verify in field.
5. Provide 2 double pull double throw micro-switches in the control head and an approved electrical box mounted to Stainless Steel Cabinet for connections. No wire connections are to be made inside control cabinet. Upon activation of system the following shall occur: All electrical under the hood, including wall outlets, are de-activated. The hood exhaust fan shall continue to operate and the hood make up air unit shall shut down.
6. Provide a 120 volt horn/strobe mounted on fire cabinet to activate upon discharge or wire into building fire alarm system as required. Complete all required pressure/puff tests, and system documentation as required by the local Fire Marshall.
7. Provide and install 1 Class K portable fire extinguisher for the kitchen. Mount in location coordinated with the Owner and/or Contractor.

Item #201 – Trash Bin – By Owner

Item #202 – Prep Table - Qty. of 1
Base Manufacturer: Eagle Metalmasters Co. Base Model: YJRAN30-SEM-BS
Alternate Manufacturer: Approved Manufacturer as listed in Section 2.03 of the General Specifications

Minimum specifications:

1. 14 gauge 304 stainless steel table as per G.S. size and shape as per plan by 34" high with 6” backsplash.
2. Stainless steel legs, gussets, and adjustable bullet feet.
3. Marine edge and sound deadened top.
4. 16 gauge stainless steel under shelf.
5. One 20" by 20" by 5" deep roller bearing drawer assembly with stainless-steel or plastic insert and an 18” by 24” white poly cutting board mounted below drawer.
6. One 16" by 19" by 14" deep coved corner sink with T&S Co. B-3990-01 modular waste drain with connected overflow, and T&S Co. or Krowne Co. 5F-8WLS12 faucet with rear connector kit.
7. 10" deep stainless steel over shelf with bottom shelf mounted 24" above table surface as shown on plan.

Item #203 – Cook’s Table - Qty. of 1
Base Manufacturer: Eagle Metalmasters Co. Base Model: YJRAN60SEM
Alternate Manufacturer: Approved Manufacturer as listed in Section 2.03 of the General Specifications.

Minimum specifications:

1. Provide 14 Gauge 304 stainless steel table size and shape as per plan by 34" high.
2. Stainless steel legs, gussets, and a minimum of two adjustable flanged feet.
3. Stainless steel sound deadened top with marine edge.
4. 16 Gauge stainless steel under shelf.
5. Two 20" by 20" by 5" deep roller bearing drawer assemblies with stainless-steel or plastic insert and an 18” by 24” white poly cutting board mounted below drawer.
6. One 16" by 20" by 14" deep coved corner sinks with T&S Co. B-3990-01 modular waste drain with connected overflows, T&S Co. or Krowne Co. 5F-8DLX12 faucet.
7. Provide circular overhead stainless steel utensil rack mounted on stainless steel tubular uprights with 2" by 3/16" stainless steel band, 12 stainless steel pot hooks and full length reinforced 14 Gauge stainless steel over shelf centered on table.

Item #204 – Portable Table - Qty. of 2
Base Manufacturer: Eagle Metalmasters Co. Base Model: YJRAN30-SE
Alternate Manufacturer: Approved Manufacturer as listed in Section 2.03 of the General Specifications.

Minimum specifications:
1. Furnish and install 14 gauge 304 stainless steel table as per G.S. size and shape as per plan by 34" high.
2. Stainless steel legs and gussets.
3. Sound deadened top.
4. One 20" by 20" by 5" deep roller bearing drawer assembly with stainless-steel or plastic insert.
5. 16 gauge stainless steel under shelf.
6. 5” heavy duty locking casters.

Item #205 – Spare Number

Item #206 – Pass Thru Hot Food Cabinet - Qty. of 1
Base Manufacturer: Traulsen Co. Base Model: AHF132WP-FHS
Alternate Manufacturer: Delfield Co.
Alternate Manufacturer: Cres-Cor Co.

Minimum specifications:
1. Furnish and install unit that operates on 208 volt single phase with cord and plug.
2. 6” stainless steel legs with adjustable bullet feet.
3. Stainless steel fronts and doors, hinged as shown on plans.
4. Aluminum interior, and stainless steel interior bottom.
5. Digital thermometer.
6. 5 sets of universal angle tray slides on top and three shelves on bottom.
7. Provide stainless steel trim at walls.
8. Stainless steel removable kick plate at serving room side.

Item #207 – Can Opener – Qty. of 1
Base Manufacturer: Edlund Co. Base Model: S-11CL
Alternate Manufacturer: Nemco Co.

Minimum specifications:
1. Stainless steel construction.
2. Clamp base with marine edge adapter.

Item #301 - Hood & Ventilation System - Qty. of 1
Base Manufacturer: Captive Aire Co. Base Model: NDFP-PSP
Alternate Manufacturer: Z-Vent Co.
Alternate Manufacturer: Accurex Co.

Minimum specifications:
1. Furnish and install 24" high single shell 18 gauge 430 series stainless steel (where exposed) hood per the General Specifications size and shape per plan to cover all cooking equipment and be mounted 6'-8" above floor with open capture ends, duct collars, grease cups and gutter, recessed 3K LED lights factory wired to junction box, hanger rods and brackets and insulated rear standoff. FSEC shall furnish and install a 20 Gauge stainless steel wall panel mounted from bottom edge of hood to top of coved base wall tile with concealed fasteners and trim strips.
2. System shall be built in accordance with and bear the seal of NFPA, NSF, and UL with 20" high

UL listed Captrate Solo stainless-steel filters running full length of hood.

3. Provide remote wall mounted variable volume control panel and HMI interface (two gang electrical junction box provided by the Trades) with fan and light switch, variable frequency drives, CAT 5 cable (installed by Trades) and room temperature sensor. Control panel to be variable volume and shall modulate exhaust fan and MUA speed during the cooking operation to maximize energy savings. Controls to include CASLink cloud-based building management system with or without BMS interlock capabilities.
4. Provide stainless steel closure panels from top of hood to ceiling and insulated full height vertical stainless-steel end panels with floor mounting legs and gas line cutout.
5. Mounted on front of hood shall be a 6” high stainless-steel supply plenum with two layers of perforated stainless steel. Supply plenum to be an air curtain type with plenum duct inlets and volume damper. The size of the supply plenum shall be determined by the discharge velocity at the bottom of the plenum which shall not exceed 250 FPM.
6. Provide UL listed 208 Volt 3 Phase make up air roof top package with direct drive motor and control panel with starters and NEMA rated weather-proof disconnects. Make up air unit to be direct gas-fired tempered makeup air unit with the capability of a 70 degree minimum temperature rise equipped with full modulating gas train, thermostat, motorized inlet damper, fire damper, heavy gauge steel base, watertight cabinet with access doors, extended intake air cabinet with filters and bird screens, and all accessories as required for a complete system. All equipment shall be sized for CFM as shown on drawing and shall conform to all applicable codes.
7. Provide UL listed 208 Volt 3 phase direct drive up blast exhaust fan with hinged curb with grease collection device, control panel with starters and NEMA rated weather-proof disconnects and all accessories as required for a complete system. All equipment shall be sized for CFM as shown on drawing and shall conform to all applicable codes.
8. Hood shall be designed to automatically activate exhaust fan whenever cooking operation occurs. The activation of the exhaust fan shall occur through an interlock with cooking appliances, by means of heat sensors or by means of other approved methods.
9. Make up Air ductwork shall conform with all applicable codes. FSEC shall provide rigid stitch welded metal makeup air ductwork (flex-duct will not be acceptable) constructed as per SMACNA requirements. If applicable, all external make up air ductwork shall be internally insulated, watertight, provided with proper support and fasteners and shall be constructed as per minimum SMACNA requirements.
10. Exhaust ductwork shall conform with all applicable codes. The FSEC shall provide continuously welded 16 Gauge black iron exhaust ductwork and shall conform to all building requirements with all dimensions subject to verification in field. All ductwork shall be furnished with cleanouts, access panels, etc. and shall be constructed as a watertight system. If applicable, all external exhaust ductwork shall be of double wall construction to accommodate 2 Hour fire blanket and painted to match building exterior or field wrapped with a galvanized metal skin and painted to match the building exterior. External exhaust duct work shall be provided with proper support and fasteners.
11. Hood and exhaust ductwork shall be 2 Hour fire rated by the FSEC.
12. The Trades shall provide wiring to inter-wire lights, control panel, HMI interface, heat sensor, exhaust fan and makeup air unit to hood control panel to interlock as required by code. This wiring shall be installed by the trades in conduit as required.
13. System is to be factory commissioned, tested and balanced as required for proper operation by FSEC with written report to Consultant, Architect and/or Owner.
14. Roof openings, fire rated walls within 18" of hood, structural support, and final connections shall be by the trades.

Item #302 - Range - Qty. of 1
Base Manufacturer: Southbend Co. Base Model: 4241E
Alternate Manufacturer: Vulcan Co.
Alternate Manufacturer: Garland Co.
Alternate Manufacturer: Montague Co.

Minimum specifications:
1. Furnish and install unit with four non-clog burners 33,000 BTU burners.
2. Standard oven.
3. Stainless steel flue riser with removable over shelf.
4. Stainless steel front and sides.
5. 5" heavy duty locking casters.
6. 3/4" rear gas connection.
7. Dormont Co. or T&S Co.1675-KIT-S-PS swivel gas hose with quick disconnect, gas valve, posi-sets, and restraint line.

Item #303 - Convection Oven - Qty. of 1
Base Manufacturer: Southbend Co. Base Model: GS-25-SC
Alternate Manufacturer: Vulcan Co.
Alternate Manufacturer: Garland Co.
Alternate Manufacturer: Montague Co.

Minimum specifications:
1. Double deck standard depth.
2. Gas fired unit that operates on 120 volt with cords and plugs.
3. Stainless steel front and sides.
4. Door windows.
5. Flue deflector.
6. 5" heavy duty locking casters.
7. Two speed motors with solid state control panel with standard controls.
8. Two Dormont Co. or T&S Co. 1675-KIT-S-PS swivel gas hose with quick disconnect, gas valve, posi-sets and restraint line.

Item #304 – Spare Number

Item #305 – Spare Number

Item #306 - Refrigerator - Qty. of 1
Base Manufacturer: Traulsen Co. Base Model: G10010
Alternate Manufacturer: Continental Co.
Alternate Manufacturer: True Co.

Minimum specifications:
1. Unit to operate on 120 volt with cord and plug and have top mount compressor.
2. Stainless steel exterior front and right door hinging.
3. Digital thermometer.
4. Three coated shelves.
5. 5” heavy duty locking casters.
6. Provide a five year warranty on compressor and one year free service plan as per G.S.

Item #401 – Hot Food Table – Qty. of 1
Base Manufacturer: LTI Co. Base Model: EF4-CPA Modified
Alternate Manufacturer: Randell Co.
Alternate Manufacturer: Delfield Co.
Alternate Manufacturer: Duke Co.

Minimum specifications:
1. Provide 34” high unit size and shape per plan that operates on 120/208 volt with cord and plug.
2. Stainless steel top, latching assembly and stainless steel undershelf.
3. Wet or dry hot food wells with drains, drain manifold with individual and master valves. Drain valves to be easily accessible from the employee side of the counter.
4. Open rear with plastic laminate front and end panels in color as selected by the Architect.
5. One 12” solid folding inverted “V” style stainless steel tray slide mounted 28” above finished floor and one 8” stainless steel solid folding work shelf mounted on rear.
6. Set of 5” heavy duty locking casters.
7. Furnish and install BSI Co. Premier Brass Co. or counter manufacturer Model #ZG9930 sneeze guard with brushed aluminum uprights and top mounted hardware, slim/stealth heat lamp, light, glass top, ends, and adjustable front. Unit shall meet current NSF standards. Center posts not acceptable.
8. Sneeze guard assembly and hot food table to be inter-wired to a common point to provide one electrical connection for entire unit and be supplied with a cord and plug.
9. Dormont Co. or T&S Co. W50B2Q-36 uncoated flexible water hose with two LFW50QD 2-way quick disconnects.
10. Fill faucet.
11. Drain tailpiece and shut off valve, garden style of drain connection is not acceptable.

Item #402 – Utility Counter – Qty. of 1
Base Manufacturer: LTI Co. Base Model: Flex Line
Alternate Manufacturer: Randell Co.
Alternate Manufacturer: Delfield Co.
Alternate Manufacturer: Duke Co.

Minimum specifications:
1. Provide 30” high unit as per plan.
2. Stainless steel top with latching assembly.
3. Plastic laminate front and end panels in color as selected by the Architect.
4. One 12” solid folding inverted “V” style stainless steel tray slide mounted 28” above finished floor.
5. Set of 5” heavy duty locking casters.
6. Stainless steel undershelf where possible.

Item #402A – Condiment Counter – Qty. of 1
Base Manufacturer: LTI Co. Base Model: Flex Line
Alternate Manufacturer: Randell Co.
Alternate Manufacturer: Delfield Co.
Alternate Manufacturer: Duke Co.

Minimum specifications:
1. Provide 30” high unit as per plan.
2. Stainless steel top with latching assembly.
3. Plastic laminate front and end panels in color as selected by the Architect.
4. Two 12” solid folding inverted “V” style stainless steel tray slide mounted 28” above finished floor.
5. Set of 5” heavy duty locking casters.
6. Stainless steel undershelf where possible with hinged doors.

Item #403 – Cold Food Table – Qty. of 1
Base Manufacturer: LTI Co. Base Model: 60-CFMA Modified
Alternate Manufacturer: Randell Co.
Alternate Manufacturer: Delfield Co.
Alternate Manufacturer: Duke Co.

Minimum specifications:
1. Provide 30” high unit as per plan with NSF-7 drop-in self-contained refrigerated cold pan with drain and shut off valve, on/off switch, and pan adapter bars. Unit shall operate on 120 Volt with cord and plug.
2. Stainless steel top, latching assembly and stainless-steel undershelf.
3. Plastic laminate front and end panels in color as selected by the Architect.
4. Two 12” solid folding inverted “V” style stainless steel tray slide as shown on plan mounted 28” above finished floor.
5. Set of 5” heavy duty locking casters.
6. Furnish and install BSI Co. Premier Brass Co. or counter manufacturer Model #ZG9930-2 sneeze guard with brushed aluminum uprights and top mounted hardware, light, glass top, ends, and adjustable front. Unit shall meet current NSF standards. Center posts not acceptable.
7. Sneeze guard assembly and cold food table to be inter-wired to a common point to provide one electrical connection for entire unit and be supplied with a cord and plug.
8. Garden hose hook style of drain connection is not acceptable.

Item #404 - Microwave Oven - Qty. of 1
Base Manufacturer: Panasonic Co. Base Model: NE-1025
Alternate Manufacturer: Amana Co.
Alternate Manufacturer: Sharp Co.

Minimum specifications:
1. Unit shall operate on 120 volt with cord and plug.
2. Unit to be mounted on an Eagle Co. MWS-1824.

Item #405 - Milk Cooler - Qty. of 1
Base Manufacturer: Beverage Air Co. Base Model: SMF58-1-S
Alternate Manufacturer: True Co.
Alternate Manufacturer: Continental Co.

Minimum specifications:
1. Self-contained forced air unit that operates on 120 volt with cord and plug.
2. Dial thermometer.
3. Lid locking device.
4. Stainless steel exterior.
5. Heavy duty locking casters.

Item #406 – Cashier Counter – Qty. of 1
Base Manufacturer: LTI Co. Base Model: Flex Line
Alternate Manufacturer: Randell Co.
Alternate Manufacturer: Delfield Co.
Alternate Manufacturer: Duke Co.

Minimum specifications:
1. Counter to be 34" high, size and shape as per plan.
2. Stainless steel top.
3. Plastic laminate front and end panels in color as selected by the Architect.
4. Two 12” solid folding inverted “V” style stainless steel tray slide as shown on plan mounted 28” above finished floor.
5. Provide enclosed base with locking ventilated door at end, one locking cash drawer and stainless steel interior under shelf.
6. Latch assembly.
7. 5” heavy duty locking casters.

Item #407 – Cash Registers / POS – By Owner.

Item #501 – Spare Number

Item #502 - Hand Sink - Qty. of 2
Base Manufacturer: Eagle Metalmasters Co. Base Model: HSA-10-LRS
Alternate Manufacturer: Approved Manufacturer as listed in Section 2.03 of the General Specifications

Minimum specifications:
1. 10” X 14” X 5” deep stainless steel sink with fully welded side splashes.
2. T&S Co. or Krowne Co. 5F-4WWX05.
3. Rear connector kit.
4. Wrist blades.
5. Soap and towel dispenser shall be provided and installed by the Contractor.

Item #503 - Pot Sink - Qty. of 1
Base Manufacturer: Eagle Metalmasters Co. Base Model: YJRAN2660-3-18
Alternate Manufacturer: Approved Manufacturer as listed in Section 2.03 of the General Specifications

Minimum specifications:
1. 14 gauge 304 unit constructed per G.S. size and shape as per plan by 34" high.
2. 9" backsplash, 21" by 26.5" by 14" deep sinks.
3. Integral drain boards.
4. One T&S Co. or Krowne Co. 5F-8WLS12 faucet, and one 5PR-8W12-C + B-TEE-RGD spray hose unit and faucet.
5. T&S Co. B-3990-01-3X modular waste drains with connected overflows.
6. Stainless steel legs, gussets, and adjustable bullet feet.
7. Area below tables is to be furnished with 16 gauge removable stainless steel under shelving where possible.
8. Provide 14" coated wire wall shelves and brackets mounted 24" above sink as shown on plans.

END OF SECTION 11 4000 – FOOD SERVICE EQUIPMENT

SECTION 11 6623 - GYMNASIUM EQUIPMENT

PART 1 - GENERAL

1.1 HYPERLINK "http://contact.arcomnet.com/ContentContact.aspx?sect=116623&ver=06/01/17&format=SF&sid=12813" SUMMARY

A. Section Includes:

1. Basketball equipment.
2. Volleyball equipment.
3. Badminton equipment.
4. Safety pads.
5. Climbing Wall with Mat System

B. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for installation of floor-insert sleeves to be cast in concrete slabs and footings.
2. Section 09 6466 "Wood Athletic Flooring" (Alternate) for game lines and markers.
3. Section 09 6566 "Resilient Athletic Flooring" for game lines and markers.

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 gymnasium equipment.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type of gymnasium equipment that requires color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Court layout plans, reflected ceiling plans, and other details, drawn to scale, and coordinated with ceiling-suspended gymnasium equipment, floor inserts, game lines, and markers applied to finished flooring, and coordinated with each other, using input from installers of the items involved.

B. Qualification Data: For Installer.

C. Product Certificates: For each type of gymnasium equipment.

D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Basketball backboard failures, including glass breakage.
   b. Faulty operation of basketball backstops.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of gymnasium equipment from single source from single manufacturer.

2.2 BASKETBALL EQUIPMENT

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

1. AALCO Manufacturing.
2. Arizona Courtlines, Inc.
3. Bison, Inc.
4. Draper Inc., Basis of Design
5. Jaypro Sports, LLC.
6. Performance Sports Systems.
7. Porter Athletic Equipment Company.

B. Standard Rules: Provide equipment according to the requirements of NFHS's "Basketball Rules Book."

C. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

D. Connections: Manufacturer's standard connections or connections recommended in writing by manufacturer and complying with Section 05 5000 "Metal Fabrications" of size and type required to transfer loads to building structure.

E. Overhead-Supported Backstops (BB-1, Main Court):

1. Folding Type: Manufacturer's standard assembly for backward-folding backstop, with hardware and fittings to permit folding.
2. Framing: Steel pipe, tubing, and shapes designed to minimize vibration during play.
    a. Center-Mast Frame: Welded and bolted or clamped with side sway bracing.
    b. Operation: Electric.
    c. Finish: Manufacturer's standard polyester powder-coat finish.

3. Goal Height Adjuster: Adjustable from 8 to 10 feet to top of ring with gear-drive mechanism, locking in any position within adjustment range, with visible height scale attached to side of framing.
    a. Operation: For main court basketball goals. Electric with integral gear-drive motor, with limit switches preset to goal heights and the following:
        1) Key switch control.

4. Goal Type: BG-3.

F. Wall-Mounted Backstops (BB-2, Side Courts): Complete assembly extending from wall, including support framing to building structure, bracing, cables, support chains, pulleys, fittings, hardware, pipe anchors, equipment pads, and fasteners.

1. Folding Type: Manufacturer's standard assembly for side-folding backstop.
2. Framing: Steel pipe, tubing, and shapes designed to minimize vibration during play.
    a. Finish: Manufacturer's standard polyester powder-coat finish.

3. Extension: 24 to 48 inches As indicated on Drawings.
4. Goal Height Adjuster: Adjustable from 8 to 10 feet to top of ring with gear-drive mechanism, locking in any position within adjustment range, with visible height scale attached to side of framing.
    a. Operation: Manual with detachable crank handle.

5. Goal Type: BG-3.

G. Backstop Safety Device: Designed to limit free fall if support cable, chains, pulleys, fittings, winch, or related components fail.

H. Backstop Electric Operator (Main Court BB-1): Provide operating machine of size and capacity recommended in writing by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components, Devices, and Accessories: Listed and labeled according to NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Motor Electrical Characteristics:

a. Horsepower: 3/4 hp.
b. Voltage: 115 V ac, single phase, 60 hertz.

3. Remote-Control Station(s): NEMA ICS 6, Type 1 enclosure for recessed or flush mounting and momentary-contact, three-position, switch-operated control with up, down, and off functions.
   a. Control Station Enclosure: Provide prime-painted metal enclosure with key access, with two sets of keys per enclosure.

4. Limit Switches: Adjustable switches at each backstop, interlocked with motor controls and set to automatically stop backstop at fully retracted and fully lowered positions.

I. Basketball Backboards (BG-3):

1. Shape and Size:
   a. Rectangular, 72 by 48 inches width by height, with rounded corners.

2. Backboard Material: Provide with predrilled holes or preset inserts for mounting goals, and as follows:
   a. Glass: Minimum 1/2-inch- thick, transparent tempered glass according to ASTM C 1048 Kind FT (fully tempered) and with impact-testing requirements in 16 CFR 1201 Category II or ANSI Z97.1 Class A for safety glazing. Provide glass and framing system manufactured according to FIBA Level 1 or Level 2 requirement that glass does not split off if broken.
      1) Frame: Provide glass with impact-absorbing resilient rubber or PVC gasket around perimeter in a fully welded, painted steel frame, with steel subframe, reinforcement, bracing, and mounting slots for mounting backboard frame to backstop.
      2) Standard Mount for wall mounted side folding backstops: Provide steel corner reinforcement with mounting slots for mounting backboard frame to backstop at standard mounting centers. Provide center-strut frame reinforcement.
      3) Direct Mount for rear folding backstops: Designed for mounting backboard frame to center mast of backstop, to maximize stress relief on backboard frame and glass.
      4) Rim-Restraining Device: According to NCAA and NFHS rules and designed to ensure that basket remains attached if glass backboard breaks.

3. Target Area and Border Markings: Permanently etched in white color, marked in pattern and stripe width according to referenced standard rules.

J. Goal-Mounting Assembly: Compatible with goal, backboard, and backstop.

K. Basketball Goals: Basket ring complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.

1. Single-rim basket ring competition goal.
2. Type: Movable, pressure-release design with manufacturer's standard breakaway mechanism in accordance with referenced rules, and rebound characteristics identical to those of fixed, nonmovable ring.
3. Finish: Polyester powder-coat finish.

L. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches long, sized to fit ring diameter, and as follows:

1. Competition Cord: Antiwhip, made from white nylon cord, minimum 120-gm thread and maximum 144-gm thread.

M. Backboard Safety Pads: Designed for backboard thickness and extending continuously along bottom and up sides of backboard and over backstop according to manufacturer's standard design, mechanically fastened to backboard.

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

2.3 VOLLEYBALL EQUIPMENT

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

1. AALCO Manufacturing.
2. Bison, Inc.
3. Draper Inc.
4. Jaypro Sports, LLC.
5. Performance Sports Systems.
6. Porter Athletic Equipment Company.
7. SNA Sports.

B. Standard Rules: Provide equipment according to the requirements of NFHS's "Volleyball Rules Book".

C. Floor Insert: Solid-brass floor plate and steel pipe sleeve, concealed by floor plate, with capped bottom end, sized with ID to fit post standards, minimum length required, to securely anchor pipe sleeve below finished floor in concrete footing; with anchors designed for securing floor insert to floor substrate indicated; quantity as indicated on Drawings. If not shown provide two per school.

1. Floor Plate Base Bid: Lockable, hinged access cover, designed to be flush with adjacent flooring. Provide two tool(s) for unlocking access covers.
2. Floor Plate Wood Floor Alternate: Lockable swivel access cover, designed for use with floating wood floors and to be flush with adjacent flooring. Provide two tool(s) for unlocking access covers.

D. Post Standards: Removable, adjustable-height, telescoping, paired volleyball post standards and a center post standard for multicourt play, as indicated on Drawings, designed for easy removal from permanently placed floor inserts.

1. Materials: Manufacturer's standard metal pipe or tubing, with nonmarking plastic or rubber end cap or floor bumper to protect permanent flooring.
2. Nominal Pipe or Tubing Diameter: 4-inch OD at base.
3. Finish: Manufacturer's standard clear anodized.
4. Net Height Adjuster: Manufacturer's standard mechanism for height adjustment, complete with fittings; designed for positioning net at heights indicated.
    a. Net Heights: Between sitting volleyball net height and boys'/men's volleyball net height, 36 and 95-5/8 inches or more.

E. Net: 32 feet long; one per pair of paired post standards; and as follows:

1. Width and Mesh: Competition volleyball net, 39 inches with 4-inch- square knotless mesh made of black nylon string.

a. Hem Band Edges: White, minimum 2-inch- wide top, bottom, and side bindings; tie offs at top, bottom, and midpoint of each side end of net; end sleeves for dowels; and lines with linkage fittings threaded through top and bottom hems of binding. Provide lengths of lines and linkage fittings as required to properly connect to and set up net for post-standard spacing indicated on Drawings.
   1) Top Line: Minimum 1/4-inch- diameter rope.
   2) Bottom Line: Minimum 1/4-inch- diameter rope.

2. Dowels: Minimum 1/2-inch- diameter fiberglass or 1-inch- diameter wood. Provide two dowels per net threaded through each side hem sleeve for straightening net side edges.
3. Net Antennas: 3/8-inch- diameter, high-tensile-strength, extruded-fiberglass or plastic rods, 72 inches long, extending above top hem band of net, with alternating white and red bands according to referenced standard rules. Provide two antennas per net.
4. Boundary Tape Markers: 2-inch- wide white strip with sleeve for securing net antenna, secured to net top and bottom with hook-and-loop attachment. Provide two tape markers per net for marking court boundaries.

F. Net-Tensioning System: Designed to adjust and hold tension of net. Fully enclosed, nonslip, manufacturer's standard-type winch with cable length and fittings for connecting to net lines, positive-release mechanism, and manufacturer's standard handle. Mount net tensioner on post standard at side away from court. Provide end post with post top pulley. Provide opposing post with welded-steel loops, hooks, pins, or other devices for net attachment and post top grooved line guide.

G. Bottom Net Lock Tightener: Manufacturer's standard.

H. Safety Pads: Consisting of minimum 1-1/4-inch- thick, multiple-impact-resistant manufacturer's standard foam filler covered by puncture- and tear-resistant fabric cover , manufacturer's standard; with fire-test-response characteristics indicated. Provide pads with hook-and-loop closure or attachments for the following components:

1. Post Standards: Wraparound style pads, designed to totally enclose each standard to a minimum height of 72 inches; one per post.
2. Net Lines: Four per net.
3. Fabric Cover Flame-Resistance Ratings: Complies with NFPA 701.
4. Fabric Color: As selected by Architect from full range of industry standard colors and color densities.

I. Post Standard Transporter: Manufacturer's standard.

J. Wall Storage Rack: Manufacturer's standard unit designed for mounting on walls and for storing post standards in vertical position, with retaining arms, fittings for padlock, and mounting hardware; number of units as required to provide storage for specified equipment.

K. Storage Cart: Manufacturer's standard wheeled unit designed for transporting and storing volleyball equipment and passing through 36-inch- wide door openings. Fabricate welded-steel tubing units with heavy-duty casters, including no fewer than two swivel casters. Fabricate wheels from materials that do not damage or mark floors; number of units as required to provide transport and storage for specified equipment.

2.4 BADMINTON EQUIPMENT

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

1. AALCO Manufacturing.
2. Bison, Inc.
3. Draper Inc.
4. Performance Sports Systems.
5. Porter Athletic Equipment Company.
6. SNA Sports.

B. Standard Rules: Provide equipment according to the requirements of BWF's "Laws of Badminton."

C. Floor Insert: Solid-brass floor plate with access cover and steel pipe sleeve with capped bottom end; sized with ID to fit post standards, minimum length required to securely anchor pipe below finished floor in concrete footing; quantity as indicated on Drawings.

D. Floor-Insert Adaptor: Pipe sleeve adaptor to convert volleyball floor-insert sleeve to fit badminton post standard; one per badminton post standard.

E. Post Standards: Paired badminton post standards, designed for easy removal from permanently placed floor inserts.

1. Material: Steel pipe or tubing, with plastic or rubber end cap or nonmarking floor bumper to protect permanent flooring.
2. Nominal Pipe or Tubing Diameter: 2-3/8-inch OD at base.
3. Finish: Manufacturer's standard factory-applied, polyester powder-coat finish.
4. Net Height Setting: By adjustable mechanism.

F. Net: Competition badminton net, 20 feet long and as follows; one per pair of paired post standards:

1. Width and Mesh: 30 inches with 3/4-inch- square mesh made of purple, dark brown, or black nylon string.
   a. Hem Band Edges: White, 3-inch- wide top binding; purple, dark brown, or black 3/4-inch-wide bottom and side bindings; sleeve with dowel, eliminating gap at each side end of net; and minimum 1/8-inch- diameter rope, at least 42 feet long, threaded through top hem of binding. Provide lengths of lines and linkage fittings as required to properly connect to and set up net for post-standard spacing indicated on Drawings.

G. Wall Storage Rack: Manufacturer's standard unit designed for mounting on walls and for storing post standards in vertical position, with retaining arms, fittings for padlock, and mounting hardware; number of units as required to provide storage for specified equipment.

H. Storage Cart: Manufacturer's standard wheeled unit designed for transporting and storing badminton equipment and passing through 36-inch- wide door openings. Fabricate welded-steel tubing units with heavy-duty casters, including no fewer than two swivel casters. Fabricate wheels from materials that do not damage or mark floors; number of units as required to provide transport and storage for specified equipment.

2.5 SAFETY PADS

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

1. AALCO Manufacturing.
2. Draper Inc.
3. Jaypro Sports, LLC.
4. Performance Sports Systems.
5. Porter Athletic Equipment Company.
6. Spalding Equipment.

B. Pad Coverings: Provide safety pad fabric covering that is fabricated from puncture- and tear-resistant, PVC-coated polyester or nylon-reinforced PVC fabric, minimum 14-oz./sq. yd. and treated with fungicide for mildew resistance; with surface-burning characteristics indicated.

C. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board, with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.

1. Backer Board: Minimum 3/8-inch- thick plywood, mat formed, or composite panel.
2. Fill: Multiple-impact-resistant foam, minimum 2-inch- thick bonded polyurethane, 6.0-lb/cu. ft. density.
3. Size: Each panel section 24 inches wide by minimum 72 inches long.
4. Number of Modular Panel Sections: As indicated on Drawings.
5. Installation Method: 1-inch top and bottom fabric attachment flange with exposed fasteners.
6. Fabric Covering Color(s): As selected by Architect from manufacturer's full range for one color(s).

D. Cutout Trim: Manufacturer's standard flanged cutout trim kits for fitting pads around switches, receptacles, and other obstructions.

1. Color: Black.

2.6 CLIMBING WALL WITH MAT SYSTEM

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

1. Basis of Design: Everlast Climbing (a Playcore Company): Standard Climbing Wall with Cordless Matt Locking System

B. System Features

1. Overall size: 8 feet high, 16 feet long.
2. Age appropriate for Elementary and Middle School students.
3. Duty to inform signage including: ‘No Climbing’ durably printed on mats in closed position and wall signage, ‘no unsupervised climbing’, age limits, etc.

C. Individual panel properties

1. Each 4' x 8' Standard Climbing Wall panel includes 20 patented Groperz® Route-Setting Hand Holds, 66 preset placement options for mounting hand holds and the Red-Relief Line®. Red-

Relief Line is a safety feature that reminds climbers to stay within a distance of three feet from the floor for foot placement.

2. Standard Finish: Lightly textured “Rock-Realistic”. Confirm with owner after bid if a change to smooth surface is desired.

D. Matt with Locking System

1. Provide 6 foot tall by 16 feet long system
2. Security latch and bolt with special allen wrench tool prevents unattended use when climbing wall is closed.
3. 3" Premium Safety Mats: With 3" of polyethylene foam enclosed in an 18-oz. polyester-reinforced vinyl covering, these mats provide an extra inch of landing surface. Mats tested and meet ASTM Standard F1292-04 (with a critical height of 8' at an ambient temperature of 66° F).
4. Provide fire resistant mats, Class C flame spread.

2.7 MATERIALS

A. Support Cable: Manufacturer's standard galvanized-stranded-steel wire rope. Provide fittings according to the wire rope manufacturer's written instructions for size, number, and installation method.

B. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80 heat-treated alloy-steel chains, according to ASTM A 391/A 391M, with commercial-quality, zinc-plated steel connectors and hangars.

C. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, according to ASTM A 413/A 413M (Grade 30 proof coil chain or higher grade recommended by gymnasium equipment manufacturer). Provide coating type, chain size, number, and installation method according to manufacturer's written instructions.

D. Castings and Hangers: Malleable iron, according to ASTM A 47/A 47M; grade as required for structural loading.

E. Softwood Plywood: DOC PS 1, exterior.

F. Particleboard: ANSI A208.1.

G. Equipment-Mounting Board: Wood, transparent or neutral-color-painted finish; size and quantity as required to mount gymnasium equipment according to manufacturer's written instructions.

H. Anchors, Fasteners, Fittings, and Hardware: Gymnasium equipment manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal- and theft-resistant design.

I. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, according to ASTM C 1107/C 1107, with minimum strength recommended in writing by gymnasium-equipment manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written installation instructions and competition rules for each type of gymnasium equipment.

B. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relationship to adjacent construction; and aligned with court layout.

1. Floor-Insert Locations: Coordinate locations with application of game lines and markers, and core drill floor for inserts after game lines are applied.
2. Floor-Insert Elevation: Coordinate installed heights of floor inserts with installation and field finishing of finish flooring and floor-plate type.
3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.

C. Floor-Insert Setting: Clean oversized, recessed voids in concrete substrate of debris. Position each sleeve, and fill void around sleeve with grout, mixed and placed according to grout manufacturer's written instructions. Protect portion of sleeve above subfloor and footing from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.

D. Wall Safety Pads, Climbing Wall and Pads: Mount with bottom edge at 4 inches above finished floor.

E. Cutout Trim: Limit cuts in face of padding so that cuts are securely and fully concealed behind trim-kit flange.

F. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.

G. Connections: Connect electric operators to building electrical system.

H. Removable Gymnasium-Equipment Components: Assemble in place to verify that equipment and components are complete and in proper working order. Disassemble removable gymnasium equipment after assembled configuration is approved by Architect Owner, and store units in location indicated on Drawings.

I. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly; free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range; and lubricate as recommended in writing by manufacturer.

3.2 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment.

END OF SECTION 11 6623

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SECTION 11 6800 - PLAYFIELD EQUIPMENT AND STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Basketball Goals
2. Play Equipment
3. Logs
4. Football Goal Post
5. Soccer Goals

1.2 SUMMARY

A. Related Sections:

1. Section 32 1816.13 "Playground Protective Surfacing" for protective surfacing under and around playground equipment.

1.3 DEFINITIONS

A. Fall Height: According to ASTM F 1487, "the vertical distance between a designated play surface and the protective surfacing beneath it."

B. HDPE: High-density polyethylene.

C. IPEMA: International Play Equipment Manufacturers Association.

D. LLDPE: Linear low-density polyethylene.

E. MDPE: Medium-density polyethylene.

F. CPSC: Consumer Product Safety Commission

G. Use Zone: According to ASTM F 1487, the "area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from or exiting the equipment."

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For playground equipment and structures. Include plans, elevations, sections, details, including footings and attachments to other work.

C. Submit color options for each play equipment from manufacture's standard colors.

D. Samples for Initial Selection: For each type of playground equipment and structure indicated.

1. Manufacturer's color charts.
2. Include similar Samples of playground equipment and accessories involving color selection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer.

B. Qualification Data: For qualified Installer.

C. Product Certificates: For each type of playground equipment, from manufacturer.

D. Product test reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.

B. Installer Qualifications: An employer of workers approved by manufacturer.

C. Safety Standards: Provide playground equipment complying with or exceeding requirements in ASTM F 1487 CPSC No. 325.

D. Preinstallation Conference: Conduct conference at Project site.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PLAYGROUND EQUIPMENT AND STRUCTURES

A. Play Equipment: All play equipment identified on plans:

1. Basis-of-Design Product: Subject to compliance with requirements, provide GameTime, www.Gametime.com equipment as shown on plans. Colors to be GameTime Forester Palette, provide samples for verification. Or approved comparable product.

B. Logs.:

1. Product: Logs to be cut within past 24 month period, 100% natural with no rotted areas. Bark to be 100% intact with no damaged, peeling or chipped areas. Fresh cut ends and ensure entire ends are smooth. Chamfer edges creating smooth end edges. No sharp edges, pieces of loose splinter areas. Architect to approve final log conditions and installation.

2.2 BASKETBALL GOALS

A. Basketball Goals: Gooseneck Post at 6 foot extension.

1. Basis-of-Design Product: Subject to compliance with requirements, provide heavy duty 4.5 inch gooseneck pole with 60 inch safe play area extension by Bison, Inc., www.bisoninc.com. Package PR60XL with heavy support braces, BA47 ultimate rectangle 12 gauge backboard, BA39U ultimate goal and nylon net. Or approved comparable product.

2.1 SOCCER GOALS

A. Permanent Soccer Goals.

1. Basis-of-Design Product: Subject to compliance with requirements, Permanent Soccer Goals by Bison Inc., Model number SC09451GA, size 9 feet x 4.5 feet high, with net. Install in concrete per manufacture. Or approved comparable product.

2.2 FOOTBALL GOALS

A. Permanent Football Goals.

1. Basis-of-Design Product: Subject to compliance with requirements, Permanent Football Goals by Bison Inc., model number FB45HS-SY, 4.5 inch Gooseneck Goalposts, yellow. Or approved comparable product.

2.3 CAST-IN-PLACE CONCRETE

A. Concrete Materials and Properties: Comply with requirements in Section 03 3000 "Cast-in-Place Concrete" ACI 301 ACI 301M to produce normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch- maximum-size aggregate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.

1. Maximum Equipment Height: Coordinate installed heights of equipment and components with finished elevations of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

C. Post Set on Subgrade: Level bearing surfaces with drainage fill to required elevation.

D. Post Set with Concrete Footing: Comply with ACI 301 ACI 301M for measuring, batching, mixing, transporting, forming, and placing concrete.

1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.
   a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

2. Embedded Items: Use setting drawings and manufacturer's written instructions to ensure correct installation of anchorages for equipment.
3. Concrete Footings: Smooth top, and shape to shed water. Do no extend concrete to within fall protection mulch layer.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Certify compliance with ASTM F 1487 CPSC No. 325.

D. Prepare and submit to owner test and inspection reports.

E. Notify Architect and Owner 48 hours in advance of date and time of final inspection.

END OF SECTION 11 6800

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SECTION 12 2413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roller shades for manual operation and accessories.
2. Roller shades for motorized operation and accessories.
3. Shade fabric.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
2. Section 07 9200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shade materials, their orientation to rollers, and their seam and batten locations.

1. Manually Operated Shades: include product data sheets for product specified materials, finishes, dimensions, profiles, mounting, accessories and trims.
2. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring. Include low voltage coordination lighting controls.

C. Samples for Initial Selection: For each type and color of shade, trim and accessory material.

1. Include Samples of accessories involving color selection per manufacturer standards.

D. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shade material.

C. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

B. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section.

C. Installer for Roller Shade System - Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

D. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

E. Shade cloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC9644, ATCC9645.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

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

1. Draper Inc.
2. Hunter Douglas Contract.
3. MechoShade Systems, Inc.
4. Open Light Shades.

B. Roller Shade (RS-1):

1. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
   a. Bead Chains: Stainless steel.
   b. Bead Chains: Stainless steel.
      1) Loop Length: Full length of roller shade.
      2) Limit Stops: Provide upper and lower ball stops.
      3) Chain-Retainer Type: Clip, jamb mount.

2. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shade indicated without deflection.
   a. Roller Drive-End Location: As directed by Architect.
   b. Direction of Shade Roll: Regular, from back (exterior face) of roller.

3. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
4. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
5. Shade Material: 3% light filtering.
   a. Shade Bottom (Hem) Bar: Steel or extruded aluminum.
      1) Type: Enclosed in sealed pocket of shadeband material.
   b. Color and Finish: basket-weave pattern of fine yarn PVC and polyester blend, manufacturer standard color.

6. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
   a. Shape: L-shaped.
   b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches.
   c. Endcap Covers: To cover exposed endcaps.

2.3 MANUALLY OPERATED SHADES WITH DOUBLE ROLLERS

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

1. Draper Inc.
2. Hunter Douglas Contract.

3. MechoShade Systems, Inc.
4. Open Light Shades.

B. Roller Shade (RS-2):

1. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
   a. Bead Chains: Stainless steel.
   b. Bead Chains: Stainless steel.
      1) Loop Length: Full length of roller shade.
      2) Limit Stops: Provide upper and lower ball stops.
      3) Chain-Retainer Type: Clip, jamb mount.

2. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms weights and widths indicated without deflection.
   a. Double-Roller Mounting Configuration: Offset, outside roller over and inside roller under.
   b. Inside Roller:
      1) Drive-End Location: As directed by Architect.
      2) Direction of Shade Roll: Regular, from back (exterior face) of roller.
   c. Outside Roller:
      1) Drive-End Location: As directed by Architect.
      2) Direction of Shade Roll: Regular, from back (exterior face) of roller.

3. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.
4. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
5. Inside Shade:
   a. Shade Material: Blackout.
   b. Shade Bottom (Hem) Bar: Steel or extruded aluminum.
      1) Type: Enclosed in sealed pocket of shadeband material.
   c. Color and Finish: opaque.

6. Outside Shade:
   a. Shade Material: 3% light filtering.
   b. Shade Bottom (Hem) Bar: Steel or extruded aluminum.
      1) Type: Enclosed in sealed pocket of shadeband material.
   c. Color and Finish: basket-weave pattern of fine yarn PVC and polyester blend, manufacturer standard color.

7. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
   a. Shape: L-shaped.
   b. Height: Manufacturer's standard height required to conceal roller and shade assembly when shade is fully open.
   c. Endcap Covers: To cover exposed endcaps.

8. Side Chanel Assembly: Side-channel assembly capturing the zippered edge of shade without light gapping.
   a. Assembly: surface mounted, impact resistant.

b. Fasteners: concealed.
c. Color and Finish: aluminum, match fascia.
d. Height: refer to architectural drawings and installation location.
    1) Site verify window heights for shop drawing review.

2.4 MANUALLY OPERATED SHADES WITH DOUBLE ROLLERS

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

1. Draper Inc.
2. Hunter Douglas Contract.
3. MechoShade Systems, Inc.
4. Open Light Shades.

B. Roller Shade (RS-3):

1. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
    a. Bead Chains: Stainless steel.
    b. Bead Chains: Stainless steel.
        1) Loop Length: Full length of roller shade.
        2) Limit Stops: Provide upper and lower ball stops.
        3) Chain-Retainer Type: Clip, jamb mount.

2. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms weights and widths indicated without deflection.
    a. Double-Roller Mounting Configuration: Offset, outside roller over and inside roller under.
    b. Inside Roller:
        1) Drive-End Location: As directed by Architect.
        2) Direction of Shade Roll: Regular, from back (exterior face) of roller.
    c. Outside Roller:
        1) Drive-End Location: As directed by Architect.
        2) Direction of Shade Roll: Regular, from back (exterior face) of roller.

3. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.
4. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
5. Inside Shade:
    a. Shade Material: Blackout.
    b. Shade Bottom (Hem) Bar: Steel or extruded aluminum.
        1) Type: Enclosed in sealed pocket of shadeband material.
    c. Color and Finish: opaque.

6. Outside Shade:
    a. Shade Material: 3% light filtering.
    b. Shade Bottom (Hem) Bar: Steel or extruded aluminum.
        1) Type: Enclosed in sealed pocket of shadeband material.

c. Color and Finish: basket-weave pattern of fine yarn PVC and polyester blend, manufacturer standard color.

7. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
   a. Shapes and heights of fasciae vary among manufacturers.
   b. Shape: L-shaped.
   c. Height: Manufacturer's standard height required to conceal roller and shade assembly when shade is fully open.
   d. Endcap Covers: To cover exposed endcaps.

2.5 MOTOR-OPERATED, DOUBLE-ROLLER SHADES

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

1. Draper Inc.
2. Hunter Douglas Contract.
3. MechoShade Systems, Inc.
4. Open Light Shades.

B. Roller Shade (RS-4):

1. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
   a. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   b. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
      1) Electrical Characteristics: 110-V ac.
      2) Maximum Total Shade Width: As required to operate roller shades indicated.
      3) Maximum Shade Drop: As required to operate roller shades indicated.
      4) Maximum Weight Capacity: As required to operate roller shades indicated.
   c. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed mounting. Provide the following for remote-control activation of shades:
      1) Provide low voltage wiring controls integrated with lighting control system.
   d. Individual Switch Control Station: Momentary-contact, low voltage control panel in room.
   e. Switch Positions: Three.

2. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shades indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shades for service.
   a. Roller Drive-End Location: As indicated on Drawings.
   b. Direction of Shade Roll: Regular, from back (exterior face) of roller.

3. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
4. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.

5. Inside Shade:
   a. Shade Material: Blackout.
   b. Shade Bottom (Hem) Bar: Steel or extruded aluminum.
      1) Type: Enclosed in sealed pocket of shade material.
   c. Color and Finish: opaque.

6. Outside Shade:
   a. Shade Material: 3% light filtering.
   b. Shade Bottom (Hem) Bar: Steel or extruded aluminum.
      1) Type: Enclosed in sealed pocket of shade material.

7. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
8. Shapes and heights of fasciae vary among manufacturers.
9. Shape: L-shaped.
10. Height: Manufacturer's standard height required to conceal roller and shade assembly when shade is fully open.

2.6 SHADE MATERIALS

A. Shade Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Type: Woven PVC-coated fiberglass and PVC-coated polyester.
3. Weave: Basketweave.
4. Roll Width:As indicated on drawings.
5. Openness Factor: 3 percent.
6. Color: As selected by Architect from manufacturer's full range.

C. Light-Blocking Fabric (Blackout): Opaque fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Type: Fiberglass with acrylic backing.
3. Roll Width: As indicated on drawings.
4. Color: As selected by Architect from manufacturer's full range.

2.7 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shade Fabrication: Fabricate shade without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shade is equal to or greater than 1:4, provide battens and seams at uniform spacings along shade length to ensure shade tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shade and where indicated. Provide battens and seams as required by railroaded material to produce shade with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shade.

PART 3 - EXECUTION

3.1 ROLLER SHADE INSTALLATION

A. Examination: Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shade: Located so shade is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

C. Electrical Connections: Connect motor-operated roller shades to building electrical system.

D. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

E. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

F. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 2413

SECTION 12 3216 - MANUFACTURED PLASTIC-LAMINATE-FACED CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes plastic-laminate-faced cabinets of stock design.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood blocking for anchoring casework.
2. Section 06 4116 "Plastic-Laminate-Faced Architectural Cabinets" for custom-built cabinets and desks.
3. Section 09 2216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring casework.
4. Section 09 6513 "Resilient Base and Accessories" for resilient base applied to plastic-laminate-faced casework.
5. Section 12 3550.13 "Educational Casegoods."
6. Section 12 3623 "Plastic-Laminate-Clad Countertops."
7. Section 12 3661.16 "Solid Surfacing Countertops."

1.3 DEFINITIONS

A. Definitions in the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" apply to the work of this Section.

1.4 COORDINATION

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

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show fabrication details, including types and locations of hardware. Show installation details, including field joints and filler panels. Indicate manufacturer's catalog numbers for casework.

C. Samples: For cabinet finishes.

D. Samples for Verification: 8-by-10-inch Samples for each type of finish.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

C. Sample Warranty: For special warranty.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation of units required for this Project.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.

B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period. Maintain temperature and relative humidity during the remainder of the construction period in range recommended for Project location by the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Delamination of components or other failures of glue bond.

b. Warping of components.
c. Failure of operating hardware.

2. Warranty Period: Five 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. Case Systems.
2. Stevens Industries, Inc.
3. TMI Systems Design Corporation.

B. Source Limitations: Obtain plastic-laminate-faced cabinets from single manufacturer.

2.2 CASEWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.

1. Grade: Premium.
2. Provide labels or certificates from AWI certification program indicating that casework complies with requirements of grades specified.

2.3 CASEWORK

A. Design: Flush overlay.

1. Flush overlay.

B. Grain Direction for Wood Grain Plastic Laminate:

1. Vertical on both doors and drawer fronts, with continuous vertical matching.
2. Vertical on end panels.
3. Vertical on knee-space panels.
4. Vertical on aprons.

C. Exposed Materials:

1. Plastic Laminate: Grade VGS.
   a. Colors and Patterns: Match Architect's sample. Refer to Material Selection Schedule on drawings.

2. Unless otherwise indicated, provide specified edgebanding on all exposed edges.

D. Semiexposed Materials:

1. Thermoset Decorative Panels: Provide thermoset decorative panels for semiexposed surfaces unless otherwise indicated.
   a. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.

E. Concealed Materials:

1. Solid Wood: Any hardwood or softwood species, with no defects affecting strength or utility.
2. Plywood: Hardwood plywood.
3. Plastic Laminate: Grade BKL.
4. Particleboard.
5. MDF.

2.4 MATERIALS

A. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

B. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated..

C. Softwood Plywood: DOC PS 1.

D. Particleboard: ANSI A208.1, Grade M-2, minimum 47 lb/cu.ft. density

E. MDF: ANSI A208.2, Grade 130

F. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.

1. Manufacturers: Subject to compliance with requirements, provide products as indicated in the Material Selection Schedule.

G. Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts..

H. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

I. Edgebanding for Thermoset Decorative Panels: PVC or polyester edgebanding matching thermoset decorative panels.

2.5 COLORS AND FINISHES

A. Thermoset Decorative Panel Colors, Patterns, and Finishes: As selected by Architect from casework manufacturer's full range.

B. Plastic-Laminate Colors, Patterns, and Finishes: As indicated by manufacturer's designations and listed in the Material Selection Color.

C. PVC Edgebanding Color: As indicated in Material Selection Schedule where applicable or as selected from casework manufacturer's full range where a selection is not provided.

2.6 FABRICATION

A. General: Shop-cut openings for hardware, appliances, plumbing fixtures, and similar items to greatest extent possible. Locate openings accurately using templates or rough in diagrams. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating. Thickness indicated are for core material and do not include laminate in thickness.

1. Construction: Join members together with glue-and-dowel construction or Mod-Eez mechanical fasteners.

B. Plastic-Laminate-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:

1. Bottoms and Ends of Cabinets, and Tops of Tall Cabinets: 3/4-inch particleboard.
2. Bottoms and Tops of Wall Cabinets: 1-inch particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semiexposed surfaces.
3. Shelves: 3/4-inch- thick particleboard. Comply with deflection standards of the National Particleboard Association.
4. Exposed Backs of Cabinets: 3/4-inch- thick particleboard.
5. Concealed Backs of Cabinets: 1/2-inch- thick particleboard dadoed into sides, bottoms, and tops.
6. Base Cabinet Subtops: 3/4-inch melamine-faced particleboard. Spreaders are not acceptable.
7. Structural Cabinet Support: Separate and continuous 4-inch high exterior grade plywood ladder-type platform design leveled and floor-mounted prior to cabinet body placement. Provide 2-1/2-inch recess at front of cabinet and 3/8-inch recess at exposed sides. No cabinet sides exposed to floor acceptable.
8. Interior Structure: For Cabinets 36 inches wide and wider, provide one of the following:
   a. Mechanically fastened and removable vertical divider to reduce horizontal shelf deflection.
   b. Fixed Intermediate Support: All shelves, tops, and bottoms, shall be 1-inch thick with fixed intermediate support.
9. Wall cabinets shall have minimum clear inside depth of 12 inches unless indicated otherwise.
10. Door and Drawer Front Rail: Minimum 3/4-by-6-inch by full horizontal width of cabinet body rails immediately behind joints between any combination of doors or drawers.
11. Drawer Fronts: 3/4-inch particleboard.
12. Drawer Sides and Backs: 1/2-inch particleboard or MDF, with glued dovetail or multiple-dowel joints.
13. Drawer Bottoms: One of the following:
    a. 1/2-inch thermoset decorative panels glued and dadoed into front, back, and sides of drawers.
    b. 1/2-inch thermoset decorative panels fastened to drawer box and supported by "L" shaped bottom corner-mount drawer slides. Fasten slides to drawer with 1-1/4-inch long screws through drawer bottoms and into sides.

14. Drawer Bottoms: 1/4-inch particleboard or MDF glued and dadoed into front, back, and sides of drawers.Use 1/2-inch material for drawers more than 24 inches wide.
15. Doors: 3/4 inch thick, with particleboard cores.

C. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.

2.7 CASEWORK HARDWARE AND ACCESSORIES

A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware.

1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

B. Butt Hinges: Stainless-steel or chrome-plated brass, semiconcealed, five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.

C. Pulls: Solid stainless-steel or chrome-plated brass wire pulls, fastened from back with two screws. For sliding doors, provide recessed stainless-steel or chrome-plated flush pulls. Provide two pulls for drawers more than 24 inches wide.

D. Door Catches: Powder-coated, nylon-roller spring catch or dual, self-aligning, permanent magnet catch. Provide two catches on doors more than 48 inches high.

E. Drawer Slides: BHMA A156.9, Type B05091.

1. Standard Duty (Grades 1, 2, and 3): Side mounted; full-extension type; epoxy-coated steel with polymer rollers.
2. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated, steel ball-bearing slides.
3. Box Drawer Slides: Grade 1HD-100, for drawers not more than 6 inches high and 24 inches wide.
4. File Drawer Slides: Grade 1HD-200, for drawers more than 6 inches high or 24 inches wide. Provide 150 lb (45 kg) load capacity.
5. Trash Bin Slides: As indicated on Drawings.
6. Paper Storage Drawers: 3-part progressive opening slide, Grade 1HD-100.

F. Drawer and Hinged Door Locks: Cylindrical (cam) type, five-pin tumbler, brass with chrome-plated finish, and complying with BHMA A156.11, Grade 1.

1. Provide a minimum of two keys per room and six master keys.
2. Provide locks where indicated.
3. Key all locks within a room alike and each room differently.

G. Sliding-Door Hardware Sets: Manufacturer's standard, to suit type and size of sliding-door units.

H. Adjustable Shelf Supports: Single-pin metal shelf rests complying with BHMA A156.9, Type B04013.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CASEWORK INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Install casework level, plumb, and true; shim as required, using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch. Bolt adjacent cabinets together with joints flush, tight, and uniform.

D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, framing, wood blocking, or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of 1/16 inch.

E. Fasten cabinets to adjacent cabinets and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

G. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 CLEANING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 12 3216

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SECTION 12 3550.13 - EDUCATIONAL CASEGOODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Freestanding and Mobile Plastic-laminate-clad educational casegoods.
2. Spanning Worksurfaces and Backsplashes.
3. Hutches.
4. Sliding Markerboard Units.
5. Tray storage units and associated rail system.
6. Filler and closure panels.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood blocking for anchoring casegoods.
2. Section 09 6513 "Resilient Base and Accessories" for resilient base applied to casegoods.

1.2 DEFINITIONS

A. Exposed Surfaces of Casegoods: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, and visible surfaces in open cabinets or behind glass doors.

1. Ends of cabinets are defined as "exposed"[except ends are defined as "concealed" where installed directly against and completely concealed by walls or other cabinets].

B. Semiexposed Surfaces of Casegoods: Surfaces behind opaque doors, such as cabinet interiors, shelves, and dividers; interiors and sides of drawers; and interior faces of doors. Tops of cases 78 inches or more above floor and bottoms of cabinets more than 24 inches, but less than 48 inches above floor, are defined as "semiexposed."

C. Typical: an assembly of individually manufactured units installed together in a specific configuration defined as each “Typical” assembly.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 COORDINATION

A. Coordinate installation of educational casegoods with installation of technology.

B. Coordinate installation of educational casegoods with paint pattern application.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For educational casegoods.

1. For Each designated Typical: Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.
   a. Indicate types and sizes of casegoods both for individual component units and completed Typical assembly.
   b. Indicate manufacturer's catalog numbers for individual component units that make up each designated Typical assembly.

C. Samples for Verification: For each type of casework, exposed-hardware, and countertop-material finish, and edgebanding in manufacturer's standard sizes.

1.6 QUALITY ASSURANCE

A. Bid must include letter from manufacturer indicating dealer is approved to purchase, install, and service the specified products, and has trained installers to oversee the specified work.

B. Installer must have minimum (3) years of experience installing specified products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install educational casegoods until building is enclosed, utility roughing-in and wet-work are complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Established Dimensions: Where educational casegoods are indicated to fit to other construction, establish dimensions for areas where casework is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C. Field Measurements: Where educational casegoods areindicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to provide a limited lifetime warranty, to repair or replace components of casework that fail in materials or workmanship for the life of the product.

1. Failures include, but are not limited to, the following:

a. Delamination of components or other failures of glue bond.
b. Warping of components.
c. Failure of operating hardware.

2. Exceptions include:
   a. Normal wear and tear.
   b. Unauthorized alterations and improper maintenance.
   c. Laminates, Casters, levelers will be covered twelve years from date of substantial completion.

PART 2 - PRODUCTS

2.1 CASEGOOD MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by Fleetwood Furniture, from product lines:

1. Illusions 2.0, Freestanding Storage Units.
2. Designer 2.0, Mobile Storage Units.

2.2 EDUCATIONAL CASEGOODS

A. Construction:

1. Horizontal, Vertical Outer, and Internal Panels, toekick and shelves:
   a. ¾" Thick 45lb density particle board substrate with balanced construction of color-matched, thermally fused laminate (TFL) on both sides
   b. Except Bottom Panels; to be 1" thick 45lb density particle board

2. Worksurfaces:
   a. 1" Thick 45lb density particleboard substrate and feature balanced construction with high pressure laminate (HPL) on top and 0.028" cabinet liner backer on bottom of worksurface.
      1) Provide smooth surfaces in uniform plane, free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch.
      2) Splashes:
      3) Flat Configuration: With square edges, flat backsplashes, and flat end splashes. Finish faces and exposed edges of splashes with color-matched pvc edgebanding.

3. Panel Edges:
   a. Permanently attached color-matched or coordinating pvc edgeband that is 3mm on front edge of top panel and 1mm on all other visible edges and panels.
      1) 3mm pvc edgeband to have 1/8" radiused top edge.
      2) Edgeband bonded with hot-melt adhesive and trimmed flush on top, bottom, and sides of all visible portions of cabinets to create pry-proof edges and structural integrity.

4. Pulls:
   a. Door and Drawer pulls to be ADA compliant “Metro” style with metallic silver finish.

5. Locks:
   a. Individual door and drawer cylinder type locking mechanisms on learning wall unit only.
      1) Locks to be keyed alike across each Typical unit.

6. Hinges: steel, five-knuckle hinges complying with ANSI/BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two for doors 48 inches high or less and three for doors more than 48 inches high.
   a. Finish to match specified door and drawer pulls.

7. Structural Reveal:
   a. ¾” x ¾” structural metal reveal integrated on the top front of all units and backs of base units to control deflections.

8. Levelers:
   a. 4 Leveling glides concealed underneath cabinet inserted into threaded steel brackets attached to the end panels and back or toekick
   b. Front levelers can be adjusted with 7/8” thin wrench at base of leveler, back levelers to be adjusted from aboe with ¼” nut driver or socket through access holes in cabinet bottom
   c. Cabinets to have an adjustment range of 1-1/4”.

9. Casters (Mobile Units):
   a. Plate-mounted 100mm diameter casters with twin-wheel swivel. Non marking thermoplastic elastomer tread for quiet use on hard or carpeted flooring.
      1) Casters tested to hold 225 pounds and roll over uneven surfaces.

10. Drawers:
    a. 20-gauge cold-rolled steel drawer construction on box and file drawers mounted to 16-gauge non-binding full-extension drawer slides on drawers.

11. Tray Storage Units:
    a. Gratnells brand insertable frosted tray storage units with interchangeable, durable plastic trays in 3”x 6”, and 12” heights.
    b. Nominal size of 12-1/2” wide and 17” deep.

12. Hutches:
    a. Hutch cabinets have 10-guage steel mounting plates factory installed to the bottom side of each hutch end panel.
    b. Hutches to be field installed to the top surface of the base cabinet or spanner worksurface.
    c. Connect adjacent hutches with through-bolt connectors.
    d. Coordinate cutouts in hutch with technology requirements and any required-wall attachments.

13. Sliding Markerboard Units:
    a. Sliding markerboard units must be coordinated with Learning Wall Hutches and Monitor hutches with extended top to provide mounting surface for top and bottom track of markerboard unit.
    b. Aluminum Extrusion Track System:

1) Provide 3-track system to accommodate up to 4 sliding markerboards.
2) Track shall be aluminum extrusions with clear satin anodized finish
3) Top track to be one piece with integral fascia,Bottom track to be one piece with smoothly curved ends.

c. Sliding markerboard panel surface:
1) Surface to be writanium 28-gauge steel face with porcelain enamel finish, fused to the steel sheet using a continuous coil process.
a) Gloss of writing surface must not increase more than (3) units when subjected to testing procedures.
2) Panel core material is ½" honeycomb with 0.015" aluminum backing sheet.
3) Panel metal trim shall be 6063 aluminum alloy with a t temper and ¾" face
4) Panels must have fingerpulls, one pair per sliding panel

d. Accessories:
1) Provide Map rail 2" High, continuous along length of track; colored-cork insert.
2) Nylon Rollers: two per panel up to 48" wide, and three per panel up to 96" wide.
3) Nylon glides: two per panel up to 48" wide, and three per panel up to 96" wide.

B. Colors and Patterns: Subject to compliance with requirements, provide:

1. Casegoods and Fillers: Wilsonart, Limber Maple
2. Worksurfaces and Splashes (Except for Learning Wall Typicals): Arborite Raw Denim
a. Worksurfaces on Learning Wall typicals to match casegood finish.

3. Door and Drawer Edgebanding:
a. Casegood and worksurface edgebanding to be pvc edgebanding, As selected by Architect from manufacturer's full range.

2.3 EDUCATIONAL CASEGOODS - TYPICALS

A. Typical Designations: Drawings indicate a reference number designated to an assembly of individual component units to complete each "Typical" Assembly. Each typical is comprised of various configurations as follows:

1. LW Learning Wall Typical Assemblies – all learning wall units must be lockable and configured as follows
a. LW-1(L) – Learning Wall, Left-hand sided TEC or LW-1(R) - Learning Wall, Right-hand sided TEC – Components Match, coordinating technology device mounting locations vary based on hand of unit. Include face filler at wall and side filler at end of run.

1) GHH1722047TN Illusions 2.0 Monitor Hutch Learning Wall - center
a) 72" W, 20" D, 47" H
b) Shop cut-out for technology mounting
2) GHL1362047TN Illusions 2.0 Hutch Learning Wall – left, 1 adjust and 1 fixed shelf.
a) 36" W, 20"D, 47" H
3) GHR1362047TN Illusions 2.0 Hutch Learning Wall – right, 1 adjust and 1 fixed shelf.
a) 36" W, 20"D, 47" H
4) GS314447 Illusions 2.0 Sliding Markerboard Unit
a) Option G (4) 36" Wide boards on (3) tracks.
b) 144" W x 47" H

5) (Quantity 2) GWSR07224 Illusions 2.0 Worksurface Spanning, no splash
   a) 72" W x 24"D
6) (Quantity 2) GXFN2437 Illusions 2.0 Base Storage Side Filler
   a) 37"H, 4" Wide
7) GSS148207LD-04337 Illusions 2.0 Base Shelf – Two adjustable shelves, locking doors.
   a) 48" W, 20"D, 37" H
   b) 5-knuckle hinges
8) (Quantity 2) GTR1482037LD-04337 Illusions 2.0 Base Tray – locking doors, Gratnells' Trays interior
   a) 48" W, 20"D, 37" H
   b) Tray Configuration A - (Quantity 24) 3" Deep Trays
   c) 5-knuckle hinges

b. LW-2(L) – Learning Wall with two-adjacent locking tall cabinets, Left-hand sided TEC or LW-2(R) - Learning Wall with two-adjacent locking tall cabinets, Right-hand sided TEC – Components Match, position of left or right hand side for adjacent locking tall cabinets and coordinating technology device mounting locations vary based on hand of unit. Include face filler at wall and side filler at end of run.
   1) GHH1722047TN Illusions 2.0 Monitor Hutch Learning Wall - center
      a) 72" W, 20" D, 47" H
      b) Shop cut-out for technology mounting
   2) GHL1362047TN Illusions 2.0 Hutch Learning Wall – left, 1 adjust and 1 fixed shelf.
      a) 36" W, 20"D, 47" H
   3) GHR1362047TN Illusions 2.0 Hutch Learning Wall – right, 1 adjust and 1 fixed shelf.
      a) 36" W, 20"D, 47" H
   4) GS314447 Illusions 2.0 Sliding Markerboard Unit
      a) Option G (4) 36" Wide boards on (3) tracks.
      b) 144" W x 47" H
   5) (Quantity 2) GWSR07224 Illusions 2.0 Worksurface Spanning, no splash
      a) 72" W x 24"D
   6) (Quantity 2) GXFN2437 Illusions 2.0 Base Storage Side Filler
      a) 37"H, 4" Wide
   7) GSS148207LD-04337 Illusions 2.0 Base Shelf – Two adjustable shelves, locking doors.
      a) 48" W, 20"D, 37" H
      b) 5-knuckle hinges
   8) (Quantity 2) GTR1482037LD-04337 Illusions 2.0 Base Tray – locking doors, Gratnells' Trays interior
      a) 48" W, 20"D, 37" H
      b) Tray Configuration A - (Quantity 24) 3" Deep Trays
      c) 5-knuckle hinges
   9) (Quantity 2) GSS1362084LD Illusions 2.0 Tall Shelf – Four Adjustable Shelves, 1 fixed shelf, locking doors.
      a) 36" W, 20" D, 84" H
      b) 5-Knuckle hinges
   10) FXFN362484 Illusions 2.0 Tall Storage Side Filler
      a) 36" W, 24" D, 84" H

c. LW-3(L) and LW-3(R) – Two locking tall cabinets, abutting wall on either left or right hand side. Include face filler at wall and side filler at end of run.
   1) (Quantity 2) GSS1302084LD Illusions 2.0 Tall Shelf – Four Adjustable Shelves, 1 fixed shelf, locking doors.
      a) 30" W, 20" D, 84" H
      b) 5-Knuckle hinges
   2) FXFN3062484 Illusions 2.0 Tall Storage Side Filler
      a) 30" W, 24" D, 84" H

d. LW-4(L) and LW-4(R) – one locking tall cabinet, abutting wall on either left or right hand side. Include face filler at wall, and side filler at end of run.
   1) GSS1302084LD Illusions 2.0 Tall Shelf – Four Adjustable Shelves, 1 fixed shelf, locking doors.
      a) 30" W, 20" D, 84" H
      b) 5-Knuckle hinges
   2) FXFN3062484 Illusions 2.0 Tall Storage Side Filler
      a) 30" W, 24" D, 84" H

e.

2. Learning Studio Typical Assemblies:
   a. LS-1 – two base tray cabinets and two base shelf cabinets with spanning worksurfaces and backsplash.
      1) (Quantity 2) GTR1422029LN Illusions 2.0 Base Tray – Gratnells' Trays interior
         a) 42" W, 20" D, 29" H
         b) Tray Configuration A - (Quantity 18) 3" Deep Trays
      2) (Quantity 2) GSS1302029LN Illusions 2.0 Base Shelf – 1 adjustable shelf
         a) 30" W, 20" D, 29" H
      3) (Quantity 2) Illusions 2.0 Spanning Worksurface
      4) (Quantity 2) Illusions 2.0 Backsplash

   b. LS-1(L) and LS-1(R) – two base tray cabinets and two base shelf cabinets with spanning worksurfaces, backsplash, and side splash. Include face filler at wall.
      1) (Quantity 2) GTR1422029LN Illusions 2.0 Base Tray – Gratnells' Trays interior
         a) 42" W, 20" D, 29" H
         b) Tray Configuration A - (Quantity 18) 3" Deep Trays
      2) (Quantity 2) GSS1302029LN Illusions 2.0 Base Shelf – 1 adjustable shelf
         a) 30" W, 20" D, 29" H
      3) (Quantity 2) Illusions 2.0 Spanning Worksurface
      4) (Quantity 2) Illusions 2.0 Backsplash
      5) GWBR04804 Illusions 2.0 Backsplash- field cut for sidesplash
         a) 48"W, 1"D, 4"H – cut to fit worksurface with filler in field.
      6) GXFN1229 Illusions 2.0 Base Storage Front Filler
         a) Field-cut and assembled.

   c. LS-2 – two base tray cabinets with spanning worksurface and backsplash.
      1) (Quantity 2) GTR1422029LN Illusions 2.0 Base Tray – Gratnells' Trays interior
         a) 42" W, 20" D, 29" H
         b) Tray Configuration A - (Quantity 18) 3" Deep Trays
      2) Illusions 2.0 Spanning Worksurface
      3) Illusions 2.0 Backsplash

d. LS-2(L) and LS-2(R) – two base tray cabinets with spanning worksurface, backsplash, and side splash. Include face filler at wall.
   1) (Quantity 2) GTR1422029LN Illusions 2.0 Base Tray – Gratnells' Trays interior
      a) 42" W, 20" D, 29" H
      b) Tray Configuration A - (Quantity 18) 3" Deep Trays
   2) Illusions 2.0 Spanning Worksurface
   3) Illusions 2.0 Backsplash
   4) GXFN1229 Illusions 2.0 Base Storage Front Filler
      a) 12" W, .75"D, 29" H
      b) Field-cut and assembled, as indicated.

e. LS-3 – two base shelf cabinets with spanning worksurface and backsplash.
   1) (Quantity 2) GSS1302029LN Illusions 2.0 Base Shelf – 1 adjustable shelf
      a) 30" W, 20" D, 29" H
   2) Illusions 2.0 Spanning Worksurface
   3) Illusions 2.0 Backsplash

f. LS-3(L) and LS-3(R) – two base shelf cabinets with spanning worksurface, backsplash, and side splash. Include face filler at wall.
   1) (Quantity 2) GSS1302029LN Illusions 2.0 Base Shelf – 1 adjustable shelf
      a) 30" W, 20" D, 29" H
   2) Illusions 2.0 Spanning Worksurface
   3) Illusions 2.0 Backsplash
   4) GXFN1229 Illusions 2.0 Base Storage Front Filler
      a) 12" W, .75"D, 29" H
      b) Field-cut and assembled, as indicated.

g. LS-4(L) and LS-4(R) – two base tray cabinets and two base shelf cabinets in L-shaped configuration (shelf-shelf | tray-tray) with spanning worksurfaces and backsplashes. Include corner filler and face filler where shelf cabinet abuts Learning Wall Typical.
   1) (Quantity 2) GTR1422029LN Illusions 2.0 Base Tray – Gratnells' Trays interior
      a) 42" W, 20" D, 29" H
      b) Tray Configuration A - (Quantity 18) 3" Deep Trays
   2) (Quantity 2) GSS1302029LN Illusions 2.0 Base Shelf – 1 adjustable shelf
      a) 30" W, 20" D, 29" H
   3) Illusions 2.0 Spanning Worksurface
      a) Extend into corner
   4) Illusions 2.0 Spanning Worksurace
   5) Illusions 2.0 Backsplash
   6) Illusions 2.0 Backsplash
      a) Extend into corner
   7) GNC1242029LN Illusions 2.0 Base Corner Filler
      a) 24" W, 20 "D, 29 " H
   8) GXFN1229 Illusions 2.0 Base Storage Front Filler
      a) 12" W, .75"D, 29" H
      b) Field-cut and assembled, as indicated.

h. LS-5(L) and LS-5(R) – two base tray cabinets and two base shelf cabinets in L-shaped configuration (shelf | shelf-tray-tray) with spanning worksurfaces and backsplashes. Include corner filler and face filler where shelf cabinet abuts Learning Wall Typical.
   1) (Quantity 2) GTR1422029LN Illusions 2.0 Base Tray – Gratnells' Trays interior

a) 42" W, 20" D, 29" H
b) Tray Configuration A - (Quantity 18) 3" Deep Trays

2) (Quantity 2) GSS1302029LN Illusions 2.0 Base Shelf – 1 adjustable shelf
a) 30" W, 20" D, 29" H

3) Illusions 2.0 Spanning Worksurface
a) Extend into corner

4) Illusions 2.0 Spanning Worksurace

5) Illusions 2.0 Backsplash

6) Illusions 2.0 Backsplash
a) Extend into corner

7) GNC1242029LN Illusions 2.0 Base Corner Filler
a) 24" W, 20 "D, 29 " H

8) GXFN1229 Illusions 2.0 Base Storage Front Filler
a) 12" W, .75"D, 29" H
b) Field-cut and assembled, as indicated.

i. LS-6(L) and LS-6(R) – two base tray cabinets and two base shelf cabinets in L-shaped configuration (tray | tray-shelf-shelf) with spanning worksurfaces and backsplashes. Include corner filler and face filler where tray cabinet abuts Learning Wall Typical.

1) (Quantity 2) GTR1422029LN Illusions 2.0 Base Tray – Gratnells' Trays interior
a) 42" W, 20" D, 29" H
b) Tray Configuration A - (Quantity 18) 3" Deep Trays

2) (Quantity 2) GSS1302029LN Illusions 2.0 Base Shelf – 1 adjustable shelf
a) 30" W, 20" D, 29" H

3) Illusions 2.0 Spanning Worksurface
a) Extend into corner

4) Illusions 2.0 Spanning Worksurace

5) Illusions 2.0 Backsplash

6) Illusions 2.0 Backsplash
a) Extend into corner

7) GNC1242029LN Illusions 2.0 Base Corner Filler
a) 24" W, 20 "D, 29 " H

8) GXFN1229 Illusions 2.0 Base Storage Front Filler
a) 12" W, .75"D, 29" H
b) Field-cut and assembled, as indicated.

j. LS-7(L) and LS-7(R) – two base tray cabinets and two base shelf cabinets in L-shaped configuration (tray-tray | shelf-shelf) with spanning worksurfaces and backsplashes. Include corner filler and face filler where tray cabinet abuts Learning Wall Typical.

1) (Quantity 2) GTR1422029LN Illusions 2.0 Base Tray – Gratnells' Trays interior
a) 42" W, 20" D, 29" H
b) Tray Configuration A - (Quantity 18) 3" Deep Trays

2) (Quantity 2) GSS1302029LN Illusions 2.0 Base Shelf – 1 adjustable shelf
a) 30" W, 20" D, 29" H

3) Illusions 2.0 Spanning Worksurface
a) Extend into corner

4) Illusions 2.0 Spanning Worksurace

5) Illusions 2.0 Backsplash

6) Illusions 2.0 Backsplash
a) Extend into corner

7) GNC1242029LN Illusions 2.0 Base Corner Filler
a) 24" W, 20 "D, 29 " H

8) GXFN1229 Illusions 2.0 Base Storage Front Filler
   a) 12" W, .75"D, 29" H
   b) Field-cut and assembled, as indicated.

3. Mobile Storage Typical Assemblies:
   a. MS-1 – one mobile tray storage cabinet, under 32" H counters
      1) DTR14220294N Designer 2.0 Gratnells' Tray
         a) 42" W, 20" D, 29" H
         b) Tray Configuration D – (Quantity 12) 3" Deep Trays,(Quantity 3) 6" Deep Trays
   b. MS-2 – one mobile tray storage cabinet, under 27" H counters
      1) DTR14820244N Designer 2.0 Gratnells' Tray
         a) 42" W, 20" D, 24" H
         b) Tray Configuration D – (Quantity 6) 3" Deep Trays, (Quantity 3) 6" Deep Trays
   c. MS-3 – one mobile drawer storage cabinet, under 32" H counters
      1) DD513627294D Designer 2.0 Drawer-Poster, 4 box/1file non-locking drawers
         a) 36" W, 27" D, 29" H
         b) Tray Configuration D – (Quantity 12) 3" Deep Trays, (Quantity 3) 6" Deep Trays

PART 3 - EXECUTION

3.1 INSTALLATION OF CASEGOODS

A. Comply with installation requirements in SEFA 2. Install level, plumb, and true in line; Where educational casegoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet.
3. Variation of Faces of Casework from a True Plane: 1/8 inch in 10 feet.
4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

B. Install hardware uniformly and precisely.

C. Adjust operating hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.2 INSTALLATION OF WORKSURFACES

A. Comply with installation requirements in SEFA 2. Abut top and edge surfaces true in plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints where indicated on Shop Drawings.

B. Field Jointing: Where possible, make in same manner as shop-made joints, using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Shop prepare edges for field-made joints.

1. Plastic-Laminate Countertops: Secure field-made joints using concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.

C. Dress joints smooth, remove surface scratches, and clean entire surface.

3.3 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Protect countertop surfaces during construction with 6-mil plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches o.c.

END OF SECTION 12 3553.16

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SECTION 12 3623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes plastic-laminate-clad countertops.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plastic-laminate-clad countertops. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.

1. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Initial Selection: For plastic laminates.

1. Countertop edge material.

D. Samples for Verification: As follows:

1. Plastic Laminates: For each type, color, pattern, and surface finish required, 8 by 10 inches in size.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Qualification Data: For fabricator.

C. Product Certificates: For the following:

1. Composite wood products.
2. High-pressure decorative laminate.
3. Adhesives.

D. Quality Standard Compliance Certificates: AWI Quality Certification Program.

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.

1. Shop Certification: AWI's Quality Certification Program accredited participant.

B. Installer Qualifications: Fabricator of products.

C. Installer Qualifications: AWI's Quality Certification Program accredited participant.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.

B. Grade: Custom in accordance with AWI.

C. Grade: Custom in accordance with AWI.

D. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.

E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by manufacturer's designations on Drawings.

F. Edge Treatment: 3-mm PVC edging.

1. Products: As indicated on Drawings.

G. Core Material: Particleboard or MDF or Particleboard made with exterior glue

1. Core Material at Sinks: Particleboard or MDF made with exterior glue.
2. Core Thickness: 1-1/8 inch.
   a. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

H. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

I. Paper Backing: Provide paper backing on underside of countertop substrate.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.

1. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

2.3 ACCESSORIES

A. Countertop Support Brackets: As indicated on Drawings.

B. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Outside Diameter: 2 inches.
2. Color: As selected by architect from manufacturer's full range,

2.4 MISCELLANEOUS MATERIALS

A. Adhesive for Bonding Plastic Laminate: Contact cement.

B. Adhesive for Bonding Plastic Laminate: [Unpigmented contact cement] [Contact cement] [PVA] [As selected by fabricator to comply with requirements].

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:

1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

F. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 12 3623.13

SECTION 12 3653 - LABORATORY COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Laboratory countertops.
2. Laboratory countertop backsplashes.
3. Laboratory countertop end splashes.
4. Phenolic resin shelves for Art and Music.

1.2 ACTION SUBMITTALS

A. Product Data:

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.

C. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For laboratory countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

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

B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

PART 2 - PRODUCTS

2.1 LABORATORY COUNTERTOP MATERIALS

A. Phenolic-Core Material (PR-1): Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges.

1. Product: Subject to compliance with requirements, provide one of the following:
   a. Durcon, a Wilsonart Company.
   b. Formica Corp.
   c. Panolam Industries.
   d. Trespa.Color: Gray, with manufacturer's standard through-color core matching face sheet.

2. Chemical Resistance: Composite countertop material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:

2.2 COUNTERTOPS AND SHELVES

A. Countertops, General: Provide units with smooth surfaces in uniform plane, free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch.

B. Phenolic-Composite and Shelves:

1. Countertop Fabrication: Fabricate with cutouts for sinks, holes for service fittings and accessories, and butt joints assembled with epoxy adhesive and concealed metal splines.
   a. Flat Configuration: 1 inch thick with continuous drip groove on underside 1/2 inch from overhang edge and integral coved backsplash.
      1) Edges and Corners: Rounded.

2. Shelf Configuration: Flat, 3/4 inch thick.
   a. Edges and Corners: Eased.
   b. Provide shelf standards and heavy-duty brackets as follows:
      1) Basis of Design: Knape & Vogt 85 Series Standard & 185 Series Bracket System.
      2) Finish: Anochrome.

C. Countertop Fabrication: Fabricate with cutouts for sinks, holes for service fittings and accessories, and butt joints assembled with epoxy adhesive and concealed metal splines.

D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with laboratory countertop manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes and endsplashes for field assembly.

E. Joints: Fabricate countertops in sections for joining in field.

1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.

F. Cutouts and Holes:

1. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by phenolic-core material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 9200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with installation requirements in SEFA 2. Abut top and edge surfaces true in plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints where indicated on Shop Drawings.

B. Field Jointing: Where possible, make in same manner as shop-made joints, using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Shop prepare edges for field-made joints.

C. Fastening:

1. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.
2. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.

D. Provide holes and cutouts required for service fittings.

E. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.

F. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

G. Dress joints smooth, remove surface scratches, and clean entire surface.

3.2 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Protect countertop surfaces during construction with 6-mil plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches o.c.

END OF SECTION 12 3653

SECTION 12 3661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material apron fronts.
5. Solid surface material sinks.

B. Related Requirements:

1. Section 06 4116 “Plastic-Laminate Faced Architectural Cabinets”
2. Section 22 4000 "Plumbing Fixtures" for sinks and plumbing fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

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

B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material (SSM): Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Products: As noted on Material Selection Schedule located on drawings.

B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

1. At countertops with sinks, provide Grade M-2-Exterior Glue, made with binder containing no urea formaldehyde.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.

D. Backsplashes: 1/2-inch- thick, solid surface material.

E. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 9200 "Joint Sealants."

C. Support Brackets: Install support brackets as indicated on drawings.

1. Finish: powder coated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions.

E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive.

G. Install aprons to backing and countertops with adhesive.

H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard sub-tops by saturating with varnish.

I. Apply sealant to gaps at walls; comply with Section 07 9200 "Joint Sealants."

END OF SECTION 12 3661.16

SECTION 12 9300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

1. Precast Seating.
2. Precast Bollards
3. Bicycle racks.
4. Trash receptacles.
5. Shade Structure

B. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete"
2. Section 31 2000 "Earth Moving"

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

C. Samples for Verification: For each type of exposed finish, not less than 6-inch- long linear components and 4-inch- square sheet components.

D. Shop Drawings: Include plans, elevations, sections, details, including footings and attachments.

PART 2 - PRODUCTS

2.1 SEATING

A. Benches: As follows:

1. Basis-of-Design Concrete Bench Product: Subject to compliance with requirements, provide Doty & Sons, www.dotyconcrete.com, Sphere Bollards, 24 and 36 inch diameter Special Sandblast Colors. Provide Architect with all available Special Color Options. , or approved comparable product. Anchor per manufacture. Submit samples of sealer options for Architect selection.
2. Basis-of-Design Concrete Bench Product: Subject to compliance with requirements, provide Doty & Sons Rectangular Campus Bench, B56722418, 72 inch length with no legs, with Special Sandblast Finish, submit all available Special Color options and sealer options for Architect selection. or approved comparable product.
1. Basis-of-Design Concrete Bench Product: Subject to compliance with requirements, provide Doty & Sons Scalene Triangle Bench, Small Triangle, Item number B342415 with Special Sandblast Finish, submit all available Special Color options and sealer options for Architect selection. or approved comparable product.

2.2 BICYCLE RACKS

A. Bicycle Rack: As follows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide 9 bike Capitol Square racks by Madrax, Model Number CS200-9, Color to be selected by Landscape Architect from manufactures standard color Surface mounted or approved comparable product.

2.3 LITTER RECEPTACLES

A. Trash Receptacle: As follows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide LandscapeForms Gretchen side-opening, PolySite Plastic Timber, surface mount, or approved comparable product. Color to be selected from manufacture's standard colors.

2.1 FABRIC SHADE STRUCTURE

A. Shade Structure: As follows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Willy Goat Three Point Sail Shade Structure as described at www.willygoat.com, Model Number 3PTSAIL30x30x30-12-16E
   - Number of supports; Three
   - Shade Sail Connection Heights, 12 feet, 14 feet, and 16 feet, different at each support on each structure
   - Mounting; Inground mount into concrete and rebar footings
   - Dimensions; 30 feet x 30 feet x 30 feet support spacing
   - Support post colors; As selected from manufactures full range of colors by Architect
   - Fabric Sail Colors; As selected from manufactures full range of colors by Architect.
   - Wind Speed tolerance; Up to 90 MPH
   - Provided sealed engineer drawings

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored and positioned at locations indicated on Drawings.

D. Anchor Precast Concrete benches and bollards per manufactures requirements and recommendations.

END OF SECTION 12 9300

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SECTION 14 2123.16 - MACHINE-ROOM-LESS ELECTRIC TRACTION PASSENGER ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes machine-room-less electric traction passenger elevators.

B. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
2. Section 04 2000 "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
3. Section 05 1200 "Structural Steel Framing" for the following:
   a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
   b. Hoist beams.
   c. Structural-steel shapes for subsills.
4. Section 05 5000 "Metal Fabrications" for the following:
   a. Attachment plates and angle brackets for supporting guide-rail brackets.
   b. Hoist beams.
   c. Structural-steel shapes for subsills.
   d. Pit ladders.
5. Section 05 5213 "Pipe and Tube Railings" for car top railings if required.
6. Section 09 6500 "Resilient Flooring" for finish flooring in elevator cars.
7. Section 10 4416 “Fire Extinguishers” for fire extinguisher mounted to the car top
8. Section 22 1429 "Sump Pumps" for sump pumps, sumps, and sump covers in elevator pits.
9. Division 26 sections for disconnect box in lockable cabinet, near top floor elevator landing.
10. Section 27 1513 "Communications Horizontal Cabling" for telephone service for elevators and for connection to elevator controllers for remote monitoring of elevator performance. Provide firefighter phone line .
11. Section 28 3100 "Fire Detection and Alarm" for smoke detectors in elevator lobbies to initiate emergency recall operation, for heat detectors in shafts and machine rooms to disconnect power from elevator equipment before or on sprinkler activation, and for connection to elevator controllers. Relay box in top floor ceiling within 6 feet of elevator.

1.2 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include Product Data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
2. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

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

D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 3-inch- square Samples of sheet materials; and 4-inch lengths of running trim members.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

C. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway and pit layout and dimensions, as indicated on Drawings, electrical service including standby power generator, communications, fire alarm and all other items required by others, as shown and specified, are adequate for elevator system being provided.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard two-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Service Tools: Provide maintenance information, diagrams, unique tools, electronic or mechanical keys, codes, and any other similar items required for continued maintenance of elevators by any elevator service provider licensed by the authority having jurisdiction.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.9 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: 1 year 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. KONE Inc. Monospace 300 DX
2. Otis Elevator Co., Gen3 Edge
3. Schindler Elevator Corp., 3300 MRL

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

B. Accessibility Requirements: Comply with requirements for accessible elevators in the United States Access Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and shall comply with elevator seismic requirements in ASME A17.1/CSA B44.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Project Seismic Design Category: B.
3. Elevator Component Importance Factor: 1.0.
4. Design earthquake spectral response acceleration short period (Sds) for Project is 0.126 g .
5. Provide earthquake equipment required by ASME A17.1/CSA B44.

6. Provide seismic switch required by ASCE/SEI 7.

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description:

1. Rated Load: 3500 lb.
2. Rated Speed: 150 fpm.
3. Operation System: Selective-collective automatic operation.
4. Auxiliary Operations:
   a. Standby-powered lowering.
   b. Automatic dispatching of loaded car.
   c. Automatic operation of lights and ventilation fans.

5. Security Features: Card-reader operation.
6. Car Enclosures:
   a. Inside Width: Not less than 77 inches from side wall to side wall.
   b. Inside Depth: Not less than 60 inches from back wall to front wall (return panels).
   c. Inside Height: Not less than 90 inches to underside of ceiling.
   d. Front Walls (Return Panels): Satin stainless steel, ASTM A480/A480M, No. 4 finish with integral car door frames..
   e. Car Fixtures: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
   f. Side and Rear Wall Panels: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
   g. Reveals: Black.
   h. Door Faces (Interior): Satin stainless steel, ASTM A480/A480M No. 4 finish.
   i. Door Sills: Aluminum.
   j. Ceiling: Luminous ceiling.
   k. Handrails: 1/2 by 2 inches rectangular, at sides and rear of car.
   l. Floor: Manufacturer's standard carpet.
   m. Floor prepared to receive resilient flooring (specified in Section 09 6566 "Resilient Flooring").

7. Hoistway Entrances:
   a. Width: 42 inches.
   b. Height: 84 inches.
   c. Type: Single-speed side sliding or Two-speed side sliding.
   d. Frames: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
   e. Doors: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
   f. Sills: Aluminum.

8. Hall Fixtures: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
9. Additional Requirements:
   a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, ASTM A480/A480M, No. 4 finish.
   b. Provide hooks for protective pads in all cars and one complete set(s) of full-height protective pads.

2.4 TRACTION SYSTEMS

A. Elevator Machines: Permanent magnet, variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.

1. Provide regenerative system.
2. Limit total harmonic distortion of regenerated power to 5 percent per IEEE 519.
3. Provide means for absorbing regenerated power when elevator system is operating on standby power.
4. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.

B. Fluid for Hydraulic Buffers: Fire-resistant fluid.

C. Machine Beams: Provide steel framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Section 05 5000 "Metal Fabrications" for materials and fabrication.

D. Guides: Roller guides or polymer-coated, nonlubricated sliding guides. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.

B. Auxiliary Operations:

1. Single-Car Battery-Powered Automatic Evacuation: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it moves to the next floor above or below, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
2. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors begin closing.
3. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after five minutes and are re-energized before car doors open.
4. Independent Service: Keyswitch in car-control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to door close button.

C. Security features shall not affect emergency firefighters' service.

1. Card-Reader Operation: System uses card readers at car-control stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Allow space for card reader in car.
   a. Security access system equipment is specified in Division 28 Access Control.

2. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby, that causes car to return immediately to lobby and open doors for inspection. On deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.

2.6 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

2.7 CAR ENCLOSURES

A. General: Provide steel-framed car enclosures with nonremovable wall panels, with car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Subfloor: Exterior, C-C Plugged grade plywood, not less than 7/8-inch nominal thickness.
2. Floor Finish: Specified in Section 09 6500 Resilient Flooring ;
3. Stainless-Steel Wall Panels: Flush, formed-metal construction; fabricated from stainless-steel sheet.
4. Fabricate car with recesses and cutouts for signal equipment.
5. Fabricate car door frame integrally with front wall of car.
6. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
7. Sight Guards: Provide sight guards on car doors.
8. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
9. Luminous Ceiling: LED light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
10. Light Fixture Efficiency: Not less than 35 lumens/W.
11. Ventilation Fan Efficiency: Not less than 3.0 cfm/W.

2.8 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.

1. Fire-Protection Rating: 1 hour with 30-minute temperature rise of 450 deg F.

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:

1. Stainless-Steel Frames: Formed from stainless-steel sheet.
2. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches high, on both jambs of hoistway door frames.
3. Stainless-Steel Doors : Flush, hollow-metal construction; fabricated from stainless-steel sheet.
4. Sight Guards: Provide sight guards on doors matching door edges.
5. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.

6. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.9 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide vandal-resistant buttons and lighted elements illuminated with LEDs.

B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.

1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: Provide telephone jack in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Section 28 3100 "Fire Detection and Alarm."

E. Car Position Indicator: Provide digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

F. Hall Push-Button Stations: Provide one hall push-button station at each landing.

1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
2. Equip units with buttons for calling elevator and for indicating desired direction of travel.
   a. Provide for connecting units to building security access system so a card reader can be used to register calls.

3. Provide telephone jack in each unit for firefighters' two-way telephone communication service specified in Section 28 3100 "Fire Detection and Alarm."

G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide one of the following:

1. Manufacturer's standard wall-mounted units, for recessed mounting above entrance frames.
2. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
3. Units mounted in both jambs of entrance frame.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

1. At manufacturer's option, audible signals may be placed on cars.

I. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed. For each elevator, provide illuminated signals that indicate when they are operational and when they are at the designated emergency return level with doors open.

J. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

K. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.10 FINISH MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

C. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 302 or Type 304.

D. Stainless-Steel Bars: ASTM A 276, Type 304.

E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

F. Aluminum Extrusions: ASTM B 221, Alloy 6063.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

B. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

C. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

D. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.

E. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

F. Locate hall signal equipment for elevators as follows unless otherwise indicated:

1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance.
3. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

3.3 PROTECTION

A. Temporary Use: Do not use elevators during construction.

B. Temporary Use: Comply with the following requirements for elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full warranty and maintenance service in addition to that required after Substantial Completion. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity.

1. Perform maintenance during normal working hours.
2. Perform emergency callback service during normal working hours with response time of two hours or less.

3. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

END OF SECTION 14 2123.16