



PROJECT MANUAL

10 / 29 / 2024
Volume 1 of 2

Stony Brook University
Tabler Quad New Residence Hall
Stony Brook, NY

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- A. Site Information: Data in subsurface investigation reports included herein are provided to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.
 - 1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.
- B. Hydrant Flow Information: Data in hydrant flow test reports included herein are provided to the Contractor for information only.



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ASSOCIATES, INC.

Environmental & Geotechnical Engineers & Consultants

Celebrating 25 Years 1994 – 2019

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REPORT OF GEOTECHNICAL INVESTIGATION

**PROPOSED RESIDENCE HALL
TABLER DRIVE
STONY BROOK, TOWN OF BROOKHAVEN
SUFFOLK COUNTY, NEW YORK**



Prepared for:

**STONY BROOK UNIVERSITY
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Prepared by:

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**Whitestone Project No.: GJ1916425.000
September 6, 2019**

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STONY BROOK UNIVERSITY
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Attention: Mr. Kevin Rooney
Contract Manager

Regarding: REPORT OF GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENCE HALL
TABLER DRIVE
STONY BROOK, TOWN OF BROOKHAVEN
SUFFOLK COUNTY, NEW YORK
WHITESTONE PROJECT NO.: GJ1916425.000

Dear Mr. Rooney:

Whitestone Associates, Inc. (Whitestone) is pleased to submit the attached *Report of Geotechnical Investigation* for the above-referenced project. The attached report presents the results of Whitestone's soil exploration efforts and presents recommendations for design of the proposed structural foundations, floor slabs, pavements, and related earthwork associated with the proposed development.

Whitestone's geotechnical division appreciates the opportunity to be of service to Stony Brook University (SBU). Please note that Whitestone has the capability to perform the additional geotechnical engineering services recommended herein.

Please contact us at (908) 668-7777 with any questions regarding the enclosed report.

Sincerely,

WHITESTONE ASSOCIATES, INC.

Mudar Khantamr, P.E.
Project Manager

Laurence W. Keller, P.E.
Principal, Geotechnical Services

MK/pwd L:\Job Folders\2019\1916425GJ\Reports and Submittals\16425 ROGI.docx
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REPORT OF GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENCE HALL
Tabler Drive
Stony Brook, Town of Brookhaven, Suffolk County, New York

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REPORT OF GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENCE HALL
Tabler Drive
Stony Brook, Town of Brookhaven, Suffolk County, New York

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SECTION 1.0

Summary of Findings

Whitestone Associates, Inc. (Whitestone) has completed an exploration and evaluation of the subsurface conditions for the proposed residential housing building located within the southern portion of the Stony Brook University (SBU) Campus adjacent to Tabler Drive in Stony Brook, Town of Brookhaven, Suffolk County, New York. The site of the proposed construction is shown on the *Boring Location Plan* included as Figure 1.

At the time of Whitestone's exploration, the area of the proposed development was moderately-wooded. Based on existing topography shown on the August 1, 2019 *Site Plan* prepared by EYP, the area of the proposed building pad has a grade change of approximately 12 feet.

Based on the *Site Plan* and information provided by SBU, the proposed development will include clearing the wooded area and construction of a four-story residential housing building with a maximum footprint of approximately 20,175 square feet, elevator pits, new pavers, and associated new pavements, landscaping, and utilities. The proposed development may also include belowground stormwater management (SWM) areas. Details regarding the proposed SWM areas including locations, sizes, and bottom elevations were not established at the time of this report.

The subsurface exploration included drilling 23 soil borings (including associated offsets), performing one in-situ infiltration test, and collecting soil samples for laboratory analyses. The soil borings typically encountered natural glacially deposited materials below the surface cover that consisted of a mixture of sand, silt, and gravel (USCS: SP, SM, and GP-GM) with various cobbles and boulders. Static groundwater was not encountered within the borings performed with non-mud rotary drilling equipment with the deepest depth explored of approximately 50.0 feet below ground surface (fbgs), corresponding to an elevation of approximately 149.7 feet above the North American Vertical Datum of 1988 (NAVD 88).

The results of the exploration indicate that the proposed structures may be supported on conventional shallow foundations and a ground-supported floor slab designed to bear within the underlying improved natural site soils and/or on structural fill placed over the on-site natural materials provided the soils are properly evaluated, placed, and compacted as described herein. Existing fill materials were not encountered within any of the borings performed as part of this investigation.

Based on the conditions disclosed by the soil borings, Whitestone anticipates that a majority of the natural soils may be suitable for reuse as structural fill and/or backfill provided moisture contents are controlled within two percent of the optimum during favorable weather conditions. Cobbles and boulders, or similarly sized materials greater than three inches in diameter, will need to be separated from on-site soils to be placed as structural fill or backfill as detailed herein.

SECTION 2.0

Introduction

2.1 AUTHORIZATION

Mr. John L. Fogarty of SBU issued authorization to Whitestone to perform a geotechnical investigation on this site relevant to the construction of a residential housing building. The geotechnical investigation was performed in general accordance with Whitestone's May 8, 2019 proposal to SBU.

2.2 PURPOSE

The purpose of this subsurface exploration and analysis was to:

- ▶ ascertain the various soil profile components at test locations;
- ▶ estimate the engineering characteristics of the proposed foundation bearing and subgrade materials;
- ▶ provide geotechnical criteria for use by the design engineers in preparing the foundation, floor slab, pavement, and SWM design;
- ▶ provide recommendations for required earthwork and subgrade preparation;
- ▶ record groundwater levels (if encountered) at the time of the investigation and discuss the potential impact on the proposed construction; and
- ▶ recommend additional investigation and/or analysis (if warranted).

2.3 SCOPE

The scope of the exploration and analysis included the subsurface exploration, field testing and sampling, laboratory analyses, and a geotechnical engineering analysis and evaluation of the subsurface materials. This *Report of Geotechnical Investigation* is limited to addressing the site conditions related to the physical support of the proposed construction. Any references to suspicious odors, materials, or conditions are provided strictly for the client's information.

2.3.1 Field Exploration

Field exploration of the project site was conducted by means of 23 soil test borings (identified as B-1 through B-11 and 12 associated shallow offsets) performed with a track-mounted drill rig using either hollow stem augers or mud rotary and split-spoon sampling techniques. The borings were performed within or near the proposed building footprint to depths ranging from approximately 20.5 fbs to 100.0

fbgs (not including the shallow refusals). Additionally, one in-situ infiltration test was performed adjacent to boring B-1 at a depth of approximately five fbgs. Soil borings were backfilled with excavated soils generated from the investigation. The locations of the soil borings are shown on the *Boring Location Plan* included as Figure 1. *Records of Subsurface Exploration* are provided in Appendix A.

The subsurface tests were conducted in the presence of a Whitestone engineer who performed field tests, recorded visual classifications, and collected samples of the various strata encountered. The tests were located in the field using normal taping procedures and estimated right angles. These locations are presumed to be accurate within a few feet.

Soil borings and Standard Penetration Tests (SPTs) were conducted in general accordance with ASTM International (ASTM) designation D 1586. The SPT resistance value (N) can be used as an indicator of the consistency of fine-grained soils and the relative density of coarse-grained soils. The N-value for various soil types can be correlated with the engineering behavior of earthworks and foundations.

Groundwater level observations, although not encountered, were recorded during and immediately after the completion of field operations prior to backfilling the borings. Groundwater levels within the boring performed with mud rotary drilling equipment were unable to be confirmed. Seasonal variations, temperature effects, man-made effects, and recent rainfall conditions may influence the levels of the groundwater, and the observed levels will depend on the permeability of the soils. Groundwater elevations derived from sources other than seasonally observed groundwater monitor wells may not be representative of true groundwater levels.

2.3.2 Laboratory Testing Program

In addition to the field investigation, a supplemental laboratory testing program was conducted to determine additional, pertinent engineering characteristics of representative samples of on-site soils. The laboratory testing program was performed in general accordance with applicable ASTM standard test methods and included physical testing of the various strata encountered.

Physical/Textural Analysis: Representative samples of selected strata encountered were subjected to a laboratory testing program that included Atterberg limits determination (ASTM D-4318), moisture content determinations (ASTM D-2216), and washed gradation analyses (ASTM D-422) in order to perform supplementary engineering soil classifications in general accordance with ASTM D-2487. The soil strata tested were classified by the Unified Soil Classification System (USCS) and results of the laboratory testing are summarized in the following table. Quantitative test results are provided in Appendix B.

PHYSICAL/TEXTURAL ANALYSES SUMMARY							
Boring	Sample	Depth (fbgs)	Natural Moisture Content (%)	Percent Passing No. 200 Sieve	Liquid Limit (%)	Plastic Index (%)	USCS Classification
B-2	S-2	2.0 - 4.0	7.3	19.4	NP	NP	SM
B-4B	S-2	8.0 - 10.0	1.8	11.0	NP	NP	GP-GM
B-5	S-3	4.0 - 6.0	1.6	14.7	NP	NP	SM
B-7	S-2	2.0 - 4.0	2.1	17.3	NP	NP	SM
B-9	S-1	0.0 - 2.0	4.3	35.7	18	1	SM

NP = Non-Plastic

The engineering classifications are useful when considered in conjunction with the additional site data to estimate properties of the soil types encountered and to predict the soil's behavior under construction and service loads.

2.3.3 Infiltration Testing

An infiltration test was performed adjacent to boring B-1. Infiltration testing was performed using by the falling head test method. The test performed resulted in an infiltration rate of 3.0 inches per hour. Infiltration test results are provided in Appendix C.

SECTION 3.0

Site Description

3.1 LOCATION & DESCRIPTION

The subject site is located within the southern portion of the Stony Brook University Campus adjacent to Tabler Drive in Stony Brook, Town of Brookhaven, Suffolk County, New York. The area of the proposed development is bound to the north by the Circle Road and Roosevelt Drive intersection, to the south by the Toscanini building, to the west by a wooded area, and to the east by Circle Drive. The site of the proposed construction is shown on the *Boring Location Plan* included as Figure 1.

3.2 EXISTING CONDITIONS

Surface Cover/Development: At the time of Whitestone's exploration, the area of the proposed development consisted of a moderately-wooded area.

Topography: Based on existing topography shown on the *Site Plan* prepared by EYP, the area of the proposed building pad has a grade change of approximately 12 feet. Additionally, the surface elevations of the boring locations included on Whitestone's subsurface logs are based on the field survey completed by Control Point Associates, Inc.

Utilities: At the time of Whitestone's subsurface field investigation, the subject site did not appear to be serviced by existing utilities. However, utilities may be present. The utility information contained in this report is presented for general discussion only and is not intended for construction purposes.

Site Drainage: Surface runoff generally consists of sheet flow across the existing ground surface and generally appeared to flow in both northerly and southerly directions.

3.3 SITE GEOLOGY

The subject site is situated within the Coastal Plain Geomorphic Province of Central Long Island, New York. Specifically, the site is located within the Monmouth Group, Matawan Group and Magothy Formation. These formations are comprised primarily of silty clay, glauconitic sandy clay, sand and gravel. Surficial materials typically include glacial deposits associated with the Wisconsin Advance that ended approximately 10,000 years ago. Long Island is the result of glacial ice sheet advances and retreats. The uplands of Long Island are a product of moraines and kames, while depressed areas are associated with kettles or valleys carved by meltwater. Overburden materials also include man-made fill associated with past and present development of the subject site.

3.4 PROPOSED CONSTRUCTION

Based on the *Site Plan* and information provided by SBU, the proposed development will include clearing the wooded area and construction of a four-story residential housing building with a maximum footprint of approximately 20,175 square feet, elevator pits, new pavers, and associated new pavements, landscaping, and utilities. The proposed building is not anticipated to include a basement or cellar. Detailed grading has not been finalized and the finished floor elevation of the proposed building and pavement grades are not known at this time. However, based on existing grades, Whitestone anticipates that the proposed building will require cuts/fills on the order of four feet to six feet. The proposed development may also include belowground SWM areas. Details regarding the proposed SWM areas including locations, sizes, and bottom elevations were not established at the time of this report. No new site retaining walls, with the exception of the below-grade walls for the elevator pit, are anticipated at this time.

Maximum design loads are assumed to be less than the following:

- ▶ column loads - 300 kips/linear foot;
- ▶ wall loads - 15.0 kips/linear foot; and
- ▶ floor slabs - 125 pounds per square foot.

The above-referenced structural loads were assumed based upon Whitestone's previous experience with similar facilities and should be confirmed by the project structural engineer. The scope of Whitestone's investigation and the professional advice contained in this report were generated based on the project details and loading noted herein. Any revisions or additions to the design details enumerated in this report should be brought to the attention of Whitestone for additional evaluation as warranted.

SECTION 4.0

Subsurface Conditions

Details of the subsurface materials encountered are presented on the *Records of Subsurface Exploration* presented in Appendix A of this report. The subsurface soil conditions encountered in the soil borings consisted of the following generalized strata in order of increasing depth.

4.1 SUBSURFACE SOIL CONDITIONS

Surface Cover Materials: The soil borings were performed within existing grass-covered areas and encountered approximately three inches to six inches of topsoil at the surface.

Glacial Deposits: Underlying the surface cover, the borings encountered natural glacially deposited soils generally consisting of: silty sand (USCS: SM) with variable amounts of gravel/cobbles/boulders; poorly graded sand (USCS: SP) with variable amounts of gravel/cobbles/boulders; and/or poorly graded gravel with silt (USCS: GP-GM) and sand. The subsurface tests were terminated within the glacial deposits at depths ranging from approximately 20.5 fbgs to 100.0 fbgs (not including the shallow offsets). SPT N-values within coarse-grained portions of this stratum ranged between four blows per foot (bpf) and refusal (refusal defined as greater than 50 blows per six inches of split-spoon sampler advancement), generally indicating loose to very dense relative density and averaging approximately 40 bpf.

4.2 GROUNDWATER

Static groundwater was not encountered within the borings performed with non-mud rotary drilling equipment with the deepest depth explored of approximately 50.0 fbgs, corresponding to an elevation of approximately 149.7 feet above NAVD 88. Groundwater conditions likely will fluctuate seasonally and following periods of precipitation.

SECTION 5.0

Conclusions and Recommendations

5.1 GENERAL

The results of the investigation indicate that the proposed structures may be supported on conventional shallow foundations bearing within the underlying improved natural materials and/or controlled structural fill soils provided they are properly inspected, placed and compacted in accordance with Sections 5.2, 5.3, and 5.11 of this report. Whitestone anticipates that proposed floor slabs and pavements also may be supported on approved site materials and/or controlled structural fill materials following subgrade preparation as described herein.

Based on anticipated redevelopment grades, excavation difficulties should be expected throughout the site at relatively shallow depths due to the presence of glacially deposited cobbles and boulders. Excavation difficulties will be affected by the nature of the boulders, size of the excavation, depth, and equipment used.

5.2 SITE PREPARATION & EARTHWORK

Surface Cover Stripping: Prior to stripping operations, all utilities should be identified and secured. Vegetation, trees, topsoil, and organic matter should also be removed from within and at least 10 feet beyond the limits of the proposed structures as well as any other area which will require controlled structural fill placement. Tree and/or brush removal should include the removal of stumps and root material.

Surface Preparation/Proofrolling: Prior to placing any fill or subbase materials to raise or restore grades to the desired subgrade elevations, the existing exposed soils should be compacted to a firm surface with several passes in two perpendicular directions of a minimum 10-ton vibratory roller. The roller should be operated in the static mode or a kneading “sheepsfoot” roller should be used if silt and/or clay soils are encountered at subgrade elevations. The surface then should be proofrolled with a loaded tandem axle truck in the presence of the geotechnical engineer to help identify soft or loose pockets which may require removal and replacement or further investigation. Proofrolling should be performed after a suitable period of dry weather to avoid degrading an otherwise stable subgrade. Any fill or backfill should be placed and compacted in accordance with Section 5.3.

Excavation Difficulties: Cobbles and boulders encountered at the site will present excavation difficulties for foundations, utilities, and similar excavations at relatively shallow depths below the surface. Excavator difficulties will be affected by the size of the excavation depth and equipment used. Heavy excavating equipment with ripping tools will probably be effective in removing cobbles/boulders during site grading. The speed and ease of excavation will depend on the type of grading equipment, the skill of

the equipment operators, and the size of the excavation. Planned excavation depths beyond refusal depths and in confined excavations, such as for foundation embedment or utility trenches, may require ripping tools, extreme service buckets, or pneumatic hammers.

Weather Performance Criteria: Because portions of the site soils are, at least, moderately moisture sensitive and may soften when exposed to water, every effort must be made to maintain drainage of surface water runoff away from construction areas by grading and limiting the exposure of excavations and prepared subgrades to rainfall. Accordingly, excavation and fill placement procedures should be performed during favorable weather conditions. Overexcavation of saturated soils and replacement with controlled structural fill per Section 5.3 of this report may be required prior to resuming work on disturbed subgrade soils.

Subgrade/Stockpile Protection and Inspection: Every effort should be made to minimize disturbance of the on-site materials by construction traffic and surface runoff. The on-site soils will deteriorate when subjected to repeated wetting and construction traffic and likely will require extensive drying or overexcavation and replacement. Construction schedules and budgets should account for contingencies, such as importing materials to raise grades or restore overexcavations when construction must occur following wet weather or on an expedited basis. However, if properly protected and maintained during warm, dry weather as recommended herein, the site soils will provide adequate support for the proposed construction.

The site contractors should employ necessary means and methods to protect the subgrade including, but not limited to the following:

- ▶ sealing exposed subgrade soils on a daily basis with a smooth drum roller operated in static mode;
- ▶ regrading the site as needed to maintain positive drainage away from open earthwork construction areas and to prevent standing water;
- ▶ removing wet surficial soils immediately; and
- ▶ limiting exposure to construction traffic especially following inclement weather and subgrade thawing.

5.3 STRUCTURAL FILL & BACKFILL

Imported Fill Material: Any imported material placed as structural fill or backfill to raise elevations or restore design grades should consist of clean, relatively well graded sand or gravel with a maximum particle size of three inches and five percent to 15 percent of material finer than a #200 sieve.

Silts, clays, and silty or clayey sands and gravels with higher percentage of fines and with a liquid limit less than 40 and a plasticity index less than 20 may be considered subject to the owner's approval, provided that the required moisture content and compaction controls are met during favorable weather

conditions. The material should be free of clay lumps, organics, and deleterious material. Imported structural fill material should be approved by a qualified geotechnical engineer prior to delivery to the site.

On-Site Material: Based on the conditions disclosed by the soil borings, Whitestone anticipates that a majority of the natural soils may be suitable for selective reuse as structural fill and/or backfill provided moisture contents are controlled within two percent of the optimum during favorable weather conditions. Laboratory results indicate that portions of the existing site soils (USCS: SM) are moderately moisture sensitive. The reuse of these soils typically requires warm and dry weather conditions. Soil reuse will typically require mixing with a more granular material and/or drying. The on-site soils will become increasingly difficult to reuse and compact where wetted beyond the optimum moisture content. Immediate re-use of fine-grained on-site soil should not be expected.

Cobbles and boulders, or similarly sized materials greater than three inches in diameter will need to be separated from on-site soils to be placed as structural fill or backfill. Cobbles between three inches to 12 inches may be crushed or individually placed in structural fill or backfill layers deeper than two feet below proposed foundation and pavement subgrade levels. Care must be taken to individually seat any large particles and to compact soil around large particles with hand operated equipment to minimize risk of void formation. Boulders greater than 12 inches in diameter need to be crushed prior to replacement as structural fill materials. Materials greater than three inches in size should be placed a minimum of three feet from utilities.

Materials that become exceedingly wet likely will require discing and aerating that may not be practical during wet seasons. Alternatively, imported fill materials may be used to attain the desired grades and expedite earthwork operations. The stripped topsoil should not be used as fill or backfill.

Compaction and Placement Requirements: All structural fill and backfill should be placed in maximum nine-inch loose lifts and compacted to 95 percent of the maximum dry density within two percent of the optimum moisture content as determined by ASTM D 1557 (Modified Proctor). Whitestone recommends using a vibratory drum roller to compact the on-site soils or a small hand-held vibratory compactor within excavations.

Structural Fill Testing: A sample of the imported fill material or any on-site material proposed for reuse as structural fill or backfill should be submitted to the geotechnical engineer for analysis and approval at least one week prior to its use. The placement of all fill and backfill should be monitored by a qualified engineering technician to ensure that the specified material and lift thicknesses are properly installed. A sufficient number of in-place density tests should be performed to ensure that the specified compaction is achieved throughout the height of the fill or backfill.

5.4 GROUNDWATER CONTROL

Static groundwater was not encountered within the borings performed with non-mud rotary drilling equipment with the deepest depth explored of approximately 50.0 fbgs. Therefore, Whitestone anticipates that static groundwater will be deeper than proposed foundation and utility excavations and does not anticipate the need for extensive dewatering or permanent groundwater control. However, apparent trapped/perched may be expected to be encountered within the within finer-grained layers of the natural site soils (where present), especially following precipitation events. As such, construction phase dewatering of static and trapped/perched water through the use of gravity fed sump pumps should be anticipated during excavation activities for this site.

Whitestone anticipates that dewatering typically would include numerous sump pumps along the excavation perimeter and/or deep well points to lower the groundwater level.

Because the subsurface soils will soften when exposed to water, every effort must be made to maintain drainage of surface water runoff away from construction areas by grading and limiting the exposure of excavations to rainfall. Overexcavation of saturated soils and replacement with controlled structural fill and/or one foot to two feet of open graded gravel (such as 3/4 inch clean crushed stone) may be required prior to resuming work on disturbed subgrade soils.

5.5 FOUNDATIONS

Shallow Foundation Design Criteria: Whitestone recommends that the proposed structures be supported on conventional shallow spread and continuous wall footings designed to bear within the underlying improved natural soils and/or properly placed structural fill provided these materials are properly evaluated, placed and compacted in accordance with Sections 5.2, 5.3, and 5.11 of this report. Portions of the upper two feet to four feet of the natural materials were encountered in a relatively loose condition and will require in-place compaction prior to structural support (if encountered at or below proposed foundation bearing elevations). Foundations bearing within these materials may be designed using a maximum allowable net bearing pressure of 5,000 pounds per square foot.

All footing bottoms should be improved by in-trench compaction in the presence of the geotechnical engineer. Regardless of loading conditions, proposed foundations should be sized no less than minimum dimensions of 24 inches for continuous wall footings and 36 inches for isolated column footings

Footings subject to overturning should be designed so that the maximum toe pressure due to the combined effect of vertical loads and overturning moment does not exceed the recommended maximum allowable net bearing pressure. In addition, positive contact pressure should be maintained throughout the base of the footings such that no uplift or tension exists between the base of the footings and the supporting soil. Eccentrically loaded footings should be evaluated by the geotechnical engineer. Uplift loads should be resisted by the weight of the concrete. Side friction should be neglected when

proportioning the footings so that lateral resistance should be provided by friction resistance at the base of the footings. A coefficient of friction against sliding of 0.40 is recommended for use in the design of the foundations bearing within the natural site soils or imported structural fill soils.

Inspection Criteria: Whitestone recommends that the suitability of the bearing soils along the footing bottoms be verified by a geotechnical engineer prior to placing concrete for the footings. In the event that isolated areas of unsuitable materials are encountered in footing excavations, overexcavation and replacement of the materials or deeper foundation embedment may be necessary to provide a suitable footing subgrade. Any overexcavation to be restored with structural fill will need to extend at least one foot laterally beyond footing edges for each vertical foot of overexcavation. Lateral overexcavation may be eliminated if grade is restored with lean concrete. The bottoms of overexcavated areas should be compacted with static smooth drum rollers, walk-behind compactors, vibrating plates or plate tampers (“jumping jacks”) to compact locally disturbed materials and densify any underlying loose zones.

Settlement: Whitestone estimates post construction settlements of proposed foundations to be less than one inch if the recommendations outlined in this report are properly implemented. Differential settlement of foundations should be less than one-half inch.

Frost Coverage: Footings subject to frost action should be placed at least 36 inches below adjacent exterior grades or the depth required by local building codes to provide protection from frost penetration. Interior footings not subject to frost action may be placed at a minimum depth of 18 inches below the slab subgrade.

5.6 FLOOR SLABS

Whitestone anticipates that the underlying natural site soils and/or controlled structural fill will be suitable for support of the proposed floor slabs provided these materials are properly evaluated, recompacted and proofrolled in accordance with Sections 5.2, 5.3, and 5.11 of this report during favorable weather conditions. Localized areas of overexcavation may be anticipated if the subgrades are exposed to precipitation. Any areas that become softened or disturbed as a result of wetting and/or repeated exposure to construction traffic should be removed and replaced with compacted structural backfill. The properly prepared on-site soils are expected to yield a minimum subgrade modulus (k) of 150 psi/in.

A minimum four inch layer of coarse aggregate, such as AASHTO #57 stone, dense graded aggregate, or equal, should be installed below ground-supported floor slabs to provide a capillary break. An impervious membrane also should be provided as a moisture vapor barrier beneath all floor slabs. Post construction settlements of floor slabs installed in accordance with the recommendations outlined in this report are estimated to be on the order of one quarter inch.

5.7 PAVEMENT DESIGN CRITERIA

General: Whitestone anticipates that the underlying natural soils and/or compacted structural fill and/or backfill placed to raise or restore design elevations are expected to be suitable for support of the proposed pavements provided these materials are properly evaluated, compacted, and proofrolled in accordance with Sections 5.2, 5.3, and 5.11 of this report during favorable weather conditions. Localized areas of overexcavation of may be anticipated if the subgrades are exposed to precipitation.

Design Criteria: A California Bearing Ratio value of five has been assigned to the properly prepared subgrade soils for pavement design purposes. This value was correlated with pertinent soil support values and assumed traffic loads to prepare flexible and rigid pavement designs per the AASHTO *Guide for the Design of Pavement Structures*.

Design traffic loads were assumed based on typical volumes for similar facilities and correlated with 18-kip equivalent single axle loads (ESAL) for a 20 year life. The pavement design considers that the facility primarily will accommodate both automobile and limited heavier truck traffic.

Pavement Sections: The following recommended flexible pavement section is presented in the following:

FLEXIBLE PAVEMENT SECTION DESIGN		
Layer	Material	Thickness (Inches)
Asphalt Surface	NYSDOT Type 7 or 7F Top	1.5
Asphalt Base	NYSDOT Type 3 Binder	2.5
Granular Subbase	NYSDOT Type 2 Subbase	6.0

A rigid concrete pavement should be used to provide suitable support at areas of high traffic or severe turns (such as ingress/egress areas). The recommended rigid pavement is presented below in tabular format:

RIGID PAVEMENT SECTION		
Layer	Material	Thickness (Inches)
Surface	4,000 psi air-entrained concrete	5.0 ¹
Base	NYSDOT Type 2 Subbase	6.0

Note¹: The outer edges of concrete pavements are susceptible to damage as trucks move from rigid pavement to adjacent flexible pavement. Therefore, the thickness at the outer two feet of the rigid concrete pavement should be 12 inches.

Additional Design Considerations: The pavement section thickness designs presented in this report are based on the design parameters detailed herein and are contingent on proper construction, inspection, and maintenance. Additional pavement section thickness may be required by local code. The designs are

contingent on achieving the minimum soil support value in the field. To accomplish this requirement, all subgrade soil and supporting fill or backfill must be placed, compacted, and evaluated in accordance with Sections 5.2, 5.3, and 5.11 of this report. Proper drainage must be provided for the pavement structure including appropriate grading and surface water control.

The performance of the pavement also will depend on the quality of materials and workmanship. Whitestone recommends that NYSDOT standards for materials, workmanship, and maintenance be applied to this site. Project specifications should include verifying that the installed asphaltic concrete material composition is within tolerance for the specified materials and that the percentage of air voids of the installed pavement is within specified ranges for the respective materials. All rigid concrete pavements should be suitably air-entrained, jointed, and reinforced.

5.8 LATERAL EARTH PRESSURES

General: The proposed development is not anticipated to include site retaining walls. However, the proposed building will include elevator pits with associated below-grade walls. While the design of the retaining structures are beyond Whitestone's current scope of work, Whitestone would be pleased to assist with the calculation of lateral earth pressures based on the soil parameters presented herein during the structural design phase when final grading and wall geometries are available.

Lateral Earth Pressures: Temporary retaining structures and permanent retaining/below-grade walls may be required to resist lateral earth pressures. Proposed retaining/below-grade walls must be capable of withstanding active and at-rest earth pressures. Retaining/below-grade walls free to rotate generally can be designed to resist active earth pressures. Retaining/below-grade walls corners and restrained walls need to be designed to resist at-rest earth pressures. Such structures should be properly designed by the Owner's engineer. The following soil parameters apply to the encountered subsurface strata and may be used for design of the proposed temporary and permanent retaining structures.

LATERAL EARTH PRESSURE PARAMETERS		
Parameter	On-Site Soils	Imported Granular Backfill
Moist Density (γ_{moist})	140 pcf	140 pcf
Internal Friction Angle (ϕ)	28°	30°
Active Earth Pressure Coefficient (K_a)	0.36	0.33
Passive Earth Pressure Coefficient (K_p)	2.77	3.00
At-Rest Earth Pressure Coefficient (K_o)	0.53	0.50

Lateral earth pressure will depend on the backfill slope angle and the wall batter angle. A sloped backfill will add surcharge load and affect the angle of the resultant force. The effect of other surcharges will also need to be included in earth pressure calculations, including the loads imposed by adjacent structures and traffic. The effects of proposed sloped backfill surface grades, and proposed slopes beyond the toe of the

retaining structure, if applicable, must be considered when calculating resultant forces to be resisted by the retaining structure. A coefficient of friction of 0.40 against sliding may be used for concrete on the existing site soils. Retaining/below-grade wall footings should be designed so that the combined effect of vertical and horizontal resultants and overturning moment does not exceed the maximum soil bearing capacity provided in Section 5.5.

Backfill Criteria: Whitestone recommends that granular soils be used to backfill behind the proposed retaining/below-grade walls. The granular backfill materials should consist of clean, relatively well graded sand or gravel with a maximum particle size of three inches and five percent to 15 percent of material finer than a #200 sieve. The material should be free of clay lumps, organics, and deleterious material. Portions of the on-site natural soils encountered consisted of a poorly graded sand (USCS: SP) which are anticipated to be satisfactory for retaining/below-grade wall backfill. The on-site soils with an appreciable amount of fines (USCS: SM) should not be used as retaining/below-grade wall backfill. Cobbles and boulders should also not be used as retaining/below-grade wall backfill. Accordingly, imported granular soils may be required. A maximum density of 140 pcf should not be exceeded to avoid creating excessive lateral pressure on the walls during compaction operations.

Whitestone recommends that backfill directly behind any walls be compacted with light, hand-held compactors. Heavy compactors and grading equipment should not be allowed to operate within a zone of influence measured at a 45-degree angle from the base of the walls during backfilling to avoid developing excessive temporary or long-term lateral soil pressures.

Wall Drainage: Positive gravity drainage of the backfill should be provided at the base of the retaining/below-grade walls by a series of perforated pipes surrounded by at least 12 inches of clean crushed stone that discharges into a stormwater sewer or daylight to appropriate site surface drainage. Whitestone recommends that a two-foot wide zone of clean crushed stone or washed sand, separated from the backfill by a filter fabric, be constructed adjacent to the back of the wall. This zone should prevent the buildup of hydrostatic pressures and pressures from freezing moisture in the backfill above the groundwater level. The vertical drain should be tied into the gravity drainage system (perforated pipe) installed at the base of the wall. Alternatively, retaining/below-grade walls may include weep holes instead of a drain tied to the site drainage system. Where wall drainage is not provided, the wall should be designed to withstand full hydrostatic pressure.

Whitestone should be notified if any other retaining structures or design considerations requiring lateral earth pressure estimations are proposed. Specific recommendations for temporary retaining structures are beyond Whitestone's scope of work.

5.9 SEISMIC & LIQUEFACTION CONSIDERATIONS

Based on a review of the subsurface conditions relevant to the *Building Code of New York State*, last revised 2015, the subject site may be assigned a Site Class D. Liquefaction is not anticipated to

substantially impact design. Based on the Site Class, the following spectral accelerations and site coefficients are recommended:

SEISMIC SITE PARAMETERS					
F _a	F _v	S _s	S ₁	S _{ds}	S _{d1}
1.6	2.4	0.195 g	0.061 g	0.209 g	0.098 g

5.10 EXCAVATIONS

The soils encountered during this investigation within anticipated excavation depths are at least consistent with Type C Soil Conditions as defined by 29 CFR Part 1926 (OSHA) which require a maximum unbraced excavation angle of 1.5:1 (horizontal:vertical). Actual conditions encountered during construction should be evaluated by a competent person (as defined by OSHA) to ensure that safe excavation methods and/or shoring and bracing requirements are implemented.

5.11 SUPPLEMENTAL POST INVESTIGATION SERVICES

Construction Inspection and Monitoring: The owner's geotechnical engineer with specific knowledge of the subsurface conditions and design recommendations should perform inspection, testing, and consultation during construction as described in previous sections of this report. Monitoring and testing should also be performed to verify that the existing surface cover materials are properly removed and suitable materials, used for controlled fill, are properly placed and compacted over suitable subgrade soils. The proofrolling of all subgrades prior to structural support should be witnessed and documented by the owner's geotechnical engineer.

SECTION 6.0

General Comments

Supplemental recommendations may be required upon finalization of construction plans or if significant changes are made in the characteristics or location of the proposed structure. Soil bearing conditions should be checked at the appropriate time for consistency with those conditions encountered during Whitestone's geotechnical investigation.

The recommendations presented herein should be utilized by a qualified engineer in preparing the project plans and specifications. The engineer should consider these recommendations as minimum physical standards which may be superseded by local and regional building codes and structural considerations. These recommendations are prepared for the sole use of Stony Brook University for the specific project detailed and should not be used by any third party. These recommendations are relevant to the design phase and should not be substituted for construction specifications.

The possibility exists that conditions between borings may differ from those at specific boring locations, and conditions may not be as anticipated by the designers or contractors. In addition, the construction process may alter soil and rock conditions. Therefore, experienced geotechnical personnel should observe and document the construction procedures used and the conditions encountered.

Whitestone assumes that a qualified contractor will be employed to perform the construction work, and that the contractor will be required to exercise care to ensure all excavations are performed in accordance with applicable regulations and good practice. Particular attention should be paid to avoiding damaging or undermining adjacent properties and maintaining slope stability.

Whitestone recommends that the services of the geotechnical engineer be engaged to test and evaluate the soils in the footing excavations prior to concreting in order to determine that the soils will support the bearing capacities. Monitoring and testing also should be performed to verify that suitable materials are used for controlled fills and that they are properly placed and compacted over suitable subgrade soils.

The exploration and analysis of the foundation conditions reported herein are considered sufficient in detail and scope to form a reasonable basis for the foundation design. The recommendations submitted for the proposed construction are based on the available soil information and the design details furnished by Stony Brook University. Deviations from the noted subsurface conditions encountered during construction should be brought to the attention of the geotechnical engineer.

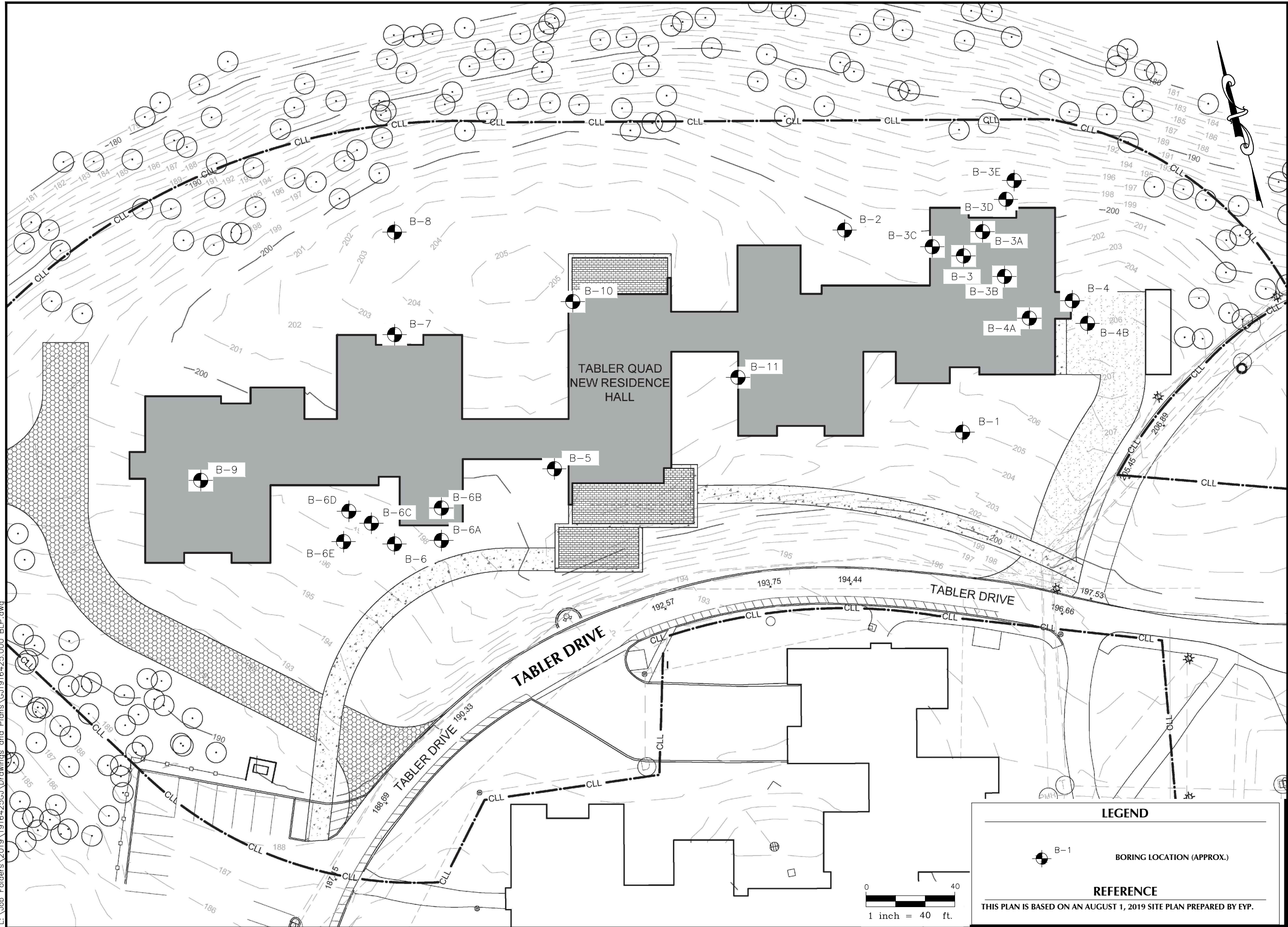
The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been promulgated after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology. No other warranties are implied or expressed.



FIGURE 1

Boring Location Plan

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DRAWING TITLE:
BORING LOCATION PLAN

CLIENT:
**STONY BROOK UNIVERSITY CAMPUS PLANNING,
DESIGN & CONSTRUCTION**

PROJECT:
**PROPOSED RESIDENCE HALL
TABLER DRIVE
STONY BROOK, TOWN OF BROOKHAVEN, SUFFOLK COUNTY, NY**

PROJECT #: GJ1916425.000	
DESIGNED BY: GR	PROJ. MGR.: MK
DATE: 9/4/19	FIGURE: 1
SCALE: 1" = 40'	

LEGEND



BORING LOCATION (APPROX.)

REFERENCE

THIS PLAN IS BASED ON AN AUGUST 1, 2019 SITE PLAN PREPARED BY EYP.



APPENDIX A

Records of Subsurface Exploration

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-1**

 Page 1 of 1

Project: Proposed Residence Hall		WAI Project No.: GJ1916425.000	
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY		Client: Stony Brook University	
Surface Elevation: ± 205.2 feet	Date Started: 8/13/2019	Water Depth Elevation (feet bgs) (feet)	Cave-In Depth Elevation (feet bgs) (feet)
Termination Depth: 25.0 feet bgs	Date Completed: 8/13/2019	During: NE --- ▼	At Completion: 6.5 198.7 ▼
Proposed Location: Building	Logged By: RL	At Completion: NE --- ▼	24 Hours: --- --- ▼
Drill / Test Method: HSA / SPT	Contractor: Tri-State	24 Hours: --- --- ▼	
	Equipment: Geoprobe		

SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0	TOPSOIL	3" Topsoil	
0 - 2	S-1	X	2 - 3 - 7 - 7	8	10	0.3	GLACIAL DEPOSITS	Light Brown Silty Sand, Dry, Medium Dense (SM)	High Gravel Content Fine Grains
2 - 4	S-2	X	9 - 15 - 12 - 15	2	27			As Above (SM)	
4 - 5.1	S-3	X	18 - 41 - 50/1"	5	91/7"	5.0		As Above, Very Dense (SM)	Hard Augering @ 4.0 fbs
6 - 6.1	S-4	X	50/1"	NR	50/1"			No Recovery, Presumed As Above (SM)	
8 - 10	S-5	X	19 - 25 - 27 - 20	6	52	10.0		As Above (SM)	
10 - 12	S-6	X	24 - 26 - 28 - 21	6	54			As Above (SM)	
15 - 17	S-7	X	21 - 28 - 25 - 23	8	53	15.0		Brown Poorly Graded Sand with Gravel, Moist, Very Dense (SP)	Medium Grains
20 - 22	S-8	X	12 - 12 - 15 - 13	6	27	20.0		As Above, Slightly Moist, Medium Dense (SP)	High Gravel Content
23 - 25	S-9	X	15 - 17 - 13 - 15	6	30	25.0		As Above (SP)	High Gravel Content
Boring Log B-1 Terminated at a Depth of 25.0 Feet Below Ground Surface									

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-2**

 Page 1 of 1

Project: Proposed Residence Hall		WAI Project No.: GJ1916425.000	
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY		Client: Stony Brook University	
Surface Elevation: ± 199.5 feet	Date Started: 8/13/2019	Water Depth Elevation (feet bgs) (feet)	Cave-In Depth Elevation (feet bgs) (feet)
Termination Depth: 25.0 feet bgs	Date Completed: 8/13/2019	During: NE --- ▼	At Completion: 10.0 189.5 ▼
Proposed Location: Building	Logged By: RL	At Completion: NE --- ▼	24 Hours: --- --- ▼
Drill / Test Method: HSA / SPT	Contractor: Tri-State	24 Hours: --- --- ▼	
	Equipment: Geoprobe		

SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0			
						0.5	TOPSOIL	6" Topsoil	
0 - 2	S-1		2 - 3 - 2 - 2	9	5		GLACIAL DEPOSITS	Brown Silty Sand with Gravel, Slightly Moist, Loose (SM)	Fine Grains
2 - 4	S-2		3 - 4 - 5 - 7	10	9			As Above (SM)	
4 - 6	S-3		15 - 15 - 19 - 24	12	34	5.0		As Above (SM)	Trace Roots High Gravel Content
6 - 7.1	S-4		19 - 25 - 50/1"	2	75/7"			As Above (SM)	
8 - 8.0	S-5		50/0"	NR	50/0"			No Recovery, Presumed As Above (SM)	Hard Augering, Spoon Refusal @ 8.0 fbgs
10 - 12	S-6		17 - 21 - 28 - 33	1	49	10.0		Low Recovery, Cobblestone (SM)	
15 - 17	S-7		12 - 14 - 18 - 18	12	32	15.0		Brown Poorly Graded Sand with Gravel, Slightly Moist, Dense (SP)	Medium Grains
20 - 22	S-8		13 - 15 - 15 - 12	12	30	20.0		As Above (SP)	
23 - 25	S-9		12 - 14 - 18 - 16	12	32	25.0		As Above (SP)	Less Gravel Content
Boring Log B-2 Terminated at a Depth of 25.0 Feet Below Ground Surface									

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-3**

 Page 1 of 1

Project: Proposed Residence Hall		WAI Project No.: GJ1916425.000	
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY		Client: Stony Brook University	
Surface Elevation: ± 203.0 feet	Date Started: 8/13/2019	Water Depth Elevation (feet bgs) (feet)	Cave-In Depth Elevation (feet bgs) (feet)
Termination Depth: 8.0 feet bgs	Date Completed: 8/13/2019	During: --- --- ▼	At Completion: --- --- ▼
Proposed Location: Building	Logged By: RL	At Completion: --- --- ▼	At Completion: --- --- ▼
Drill / Test Method: HSA / SPT	Contractor: Tri-State	24 Hours: --- --- ▼	24 Hours: --- --- ▼
	Equipment: Geoprobe		



SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0	TOPSOIL	4" Topsoil	
0 - 2	S-1		3 - 3 - 4 - 4	6	7	0.3	GLACIAL DEPOSITS	Light Brown Silty Sand, Dry, Loose (SM)	Fine Grains Hard Augering to 4.0 fbgs Medium Gravel and Cobble Content
2 - 4	S-2		5 - 6 - 7 - 6	4	13			As Above, Medium Dense (SM)	
4 - 5.1	S-3		11 - 15 - 50/1"	2	65/7"	5.0		As Above, Very Dense (SM)	
6 - 6	S-4		50/0"	NR	50/0"			No Recovery, Assumed As Above (SM)	
						8.0		No Recovery, Assumed As Above (SM)	
8 - 8	S-5		50/0"	NR	50/0"			Boring Log B-3 Terminated at a Depth of 8.0 Feet Below Ground Surface Due to Auger Refusal; See Offset Boring B-3E	Attempted Offsets B-3A through B-3D; Shallow Refusal Less Than 3.0 fbgs
						10.0			
						15.0			
						20.0			
						25.0			


NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-3E**

 Page 1 of 1

Project: Proposed Residence Hall						WAI Project No.: GJ1916425.000								
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY						Client: Stony Brook University								
Surface Elevation: ± 197.5 feet						Date Started: 8/20/2019			Water Depth Elevation (feet bgs) (feet)			Cave-In Depth Elevation (feet bgs) (feet)		
Termination Depth: 25.0 feet bgs						Date Completed: 8/20/2019								
Proposed Location: Building						Logged By: RL			During: NE --- ▼					
Drill / Test Method: HSA / SPT						Contractor: Tri-State			At Completion: NE --- ▼			At Completion: 12.0 185.5 		
						Equipment: Geoprobe			24 Hours: --- --- ▼			24 Hours: --- --- 		



SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0		Augered to 10.0 fbgs	Offset from Boring B-3
						5.0			
						10.0		GLACIAL DEPOSITS	
10 - 11.5	S-1	X	28 - 38 - 41 - 50/0"	6	79			Brown Poorly Graded Sand, Dry, Very Dense (SP)	Fine Grains High Gravel Content
						15.0			
						15.0		As Above, Dense (SP)	Medium Gravel Content
						20.0			
20 - 22	S-3	X	18 - 23 - 27 - 24	12	50		As Above, Slightly Moist, Very Dense (SP)	Medium Gravel Content	
						25.0			
23 - 25	S-4	X	24 - 22 - 30 - 27	12	52		As Above, Moist (SP)	High Gravel Content	
								Boring Log B-3E Terminated at a Depth of 25.0 Feet Below Ground Surface	



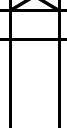
NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-4**

 Page 1 of 1

Project: Proposed Residence Hall		WAI Project No.: GJ1916425.000	
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY		Client: Stony Brook University	
Surface Elevation: ± 205.0 feet	Date Started: 8/13/2019	Water Depth Elevation (feet bgs) (feet)	Cave-In Depth Elevation (feet bgs) (feet)
Termination Depth: 5.0 feet bgs	Date Completed: 8/13/2019	During: NE --- ▼	At Completion: 5.0 200.0 
Proposed Location: Building	Logged By: RL	At Completion: NE --- ▼	24 Hours: --- --- ▼
Drill / Test Method: HSA / SPT	Contractor: Tri-State	24 Hours: --- --- ▼	24 Hours: --- --- 
	Equipment: Geoprobe		



SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0	TOPSOIL	3" Topsoil	
0 - 2	S-1		3 - 4 - 3 - 4	6	7	0.3	GLACIAL DEPOSITS	Brown Silty Sand, Dry, Loose (SM)	Fine Grains Medium Cobble Content
2 - 4	S-2		10 - 18 - 25 - 31	1	43			Very Low Recovery, Mostly Fractured Gravel (SM)	
4 - 4.5	S-3		33 - 50/0"	2	50/0"	5.0		As Above, Low Recovery, Fractured Gravel (SM)	
								Boring Log B-4 Terminated at a Depth of 5.0 Feet Below Ground Surface Due to Auger Refusal; Offset to Boring B-4A	
						10.0			
						15.0			
						20.0			
						25.0			


NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-4A**

 Page 1 of 1

Project: Proposed Residence Hall						WAI Project No.: GJ1916425.000								
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY						Client: Stony Brook University								
Surface Elevation: ± 205.0 feet						Date Started: 8/14/2019			Water Depth Elevation (feet bgs) (feet)			Cave-In Depth Elevation (feet bgs) (feet)		
Termination Depth: 5.0 feet bgs						Date Completed: 8/14/2019								
Proposed Location: Building						Logged By: RL			During: NE --- ▼					
Drill / Test Method: HSA / SPT						Contractor: Tri-State			At Completion: NE --- ▼			At Completion: 3.0 202.0 		
						Equipment: Geoprobe			24 Hours: --- --- ▼			24 Hours: --- --- 		

SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0		Augered to 5.0 fbg	Offset from Boring B-4
						5.0			
						10.0		Boring Log B-4A Terminated at a Depth of 5.0 Feet Below Ground Surface Due to Auger Refusal; Offset to Boring B-4B	
						15.0			
						20.0			
						25.0			

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-4B**

 Page 1 of 1

Project: Proposed Residence Hall						WAI Project No.: GJ1916425.000								
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY						Client: Stony Brook University								
Surface Elevation: ± 206.0 feet						Date Started: 8/14/2019			Water Depth Elevation (feet bgs) (feet)			Cave-In Depth Elevation (feet bgs) (feet)		
Termination Depth: 20.5 feet bgs						Date Completed: 8/14/2019								
Proposed Location: Building						Logged By: RL			During: --- --- ▼					
Drill / Test Method: HSA / SPT						Contractor: Tri-State			At Completion: --- --- ▼			At Completion: --- --- ▼		
						Equipment: Geoprobe			24 Hours: --- --- ▼			24 Hours: --- --- ▼		

SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0			
						5.0			
						6.0			
6 - 6	S-1	X	50/0"	NR	50/0"		GLACIAL DEPOSITS	Augered to 6.0 fbgs	Offset from Boring B-4A
								No Recovery, Presumed As Below (GP-GM)	Spoon Refusal
8 - 10	S-2	X	27 - 31 - 26 - 24	6	57			Brown Poorly Graded Gravel with Silt and Sand, Dry, Very Dense (GP-GM)	Fine Grains
10 - 12	S-3	X	18 - 24 - 22 - 31	6	46			As Above, Dense (GP-GM)	
						15.0		As Above (GP-GM)	
15 - 17	S-4	X	18 - 22 - 17 - 26	4	39			As Above (GP-GM)	
						20.0		As Above (GP-GM)	
20 - 20.4	S-5	X	50/5"	4	50/5"	20.5		Boring Log B-4B Terminated at a Depth of 20.5 Feet Below Ground Surface	
						25.0			

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-5**

 Page 1 of 2

Project: Proposed Residence Hall		WAI Project No.: GJ1916425.000	
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY		Client: Stony Brook University	
Surface Elevation: ± 199.7 feet	Date Started: 8/14/2019	Water Depth Elevation (feet bgs) (feet)	Cave-In Depth Elevation (feet bgs) (feet)
Termination Depth: 50.0 feet bgs	Date Completed: 8/14/2019	During: NE --- ▼	At Completion: 8.0 191.7 ▼
Proposed Location: Building	Logged By: RL	At Completion: NE --- ▼	24 Hours: --- --- ▼
Drill / Test Method: HSA / SPT	Contractor: Tri-State	24 Hours: --- --- ▼	
	Equipment: Geoprobe		

SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0	TOPSOIL	3" Topsoil	
0 - 2	S-1		2 - 2 - 3 - 3	6	5	0.3	GLACIAL DEPOSITS	Brown Silty Sand, Dry, Loose (SM)	Fine Grains
2 - 4	S-2		3 - 4 - 5 - 4	12	9			As Above, Light Brown (SM)	Trace Cobble Hard Augering @ 3.0 fbs to 13.0 fbs
4 - 6	S-3		13 - 15 - 25 - 30	8	40	5.0		As Above, Dense (SM)	High Gravel Content
6 - 8	S-4		22 - 26 - 31 - 22	4	57			As Above, Very Dense (SM)	
8 - 8	S-5		50/0"	NR	50/0"			No Recovery, Presumed As Below (SM)	
						10.0		As Above (SM)	
10 - 11.1	S-6		21 - 36 - 50/1"	6	86/7"				
						15.0			
15 - 17	S-7		23 - 21 - 17 - 28	8	38			Orangish-Brown Poorly Graded Sand, Slightly Moist, Dense (SP)	
						20.0			
20 - 22	S-8		33 - 30 - 28 - 33	8	58			As Above, Orange, Moist, Very Dense (SP)	High Gravel Content
						25.0			


NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-5**

 Page 2 of 2

Project: Proposed Residence Hall		WAI Project No.: GJ1916425.000	
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY		Client: Stony Brook University	
Surface Elevation: ± 199.7 feet	Date Started: 8/14/2019	Water Depth Elevation (feet bgs) (feet)	Cave-In Depth Elevation (feet bgs) (feet)
Termination Depth: 50.0 feet bgs	Date Completed: 8/14/2019	During: NE --- ▼	At Completion: 8.0 191.7 ▼
Proposed Location: Building	Logged By: RL	At Completion: NE --- ▼	24 Hours: --- --- ▼
Drill / Test Method: HSA / SPT	Contractor: Tri-State	At Completion: 8.0 191.7 ▼	
	Equipment: Geoprobe	24 Hours: --- --- ▼	



SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						25.0	GLACIAL DEPOSITS		Orange Poorly Graded Sand, Moist, Very Dense (SP)	High Gravel Content
25 - 27	S-9	X	28 - 36 - 24 - 37	18	60					
						30.0				
30 - 32	S-10	X	21 - 25 - 27 - 29	12	52				As Above (SP)	








NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-6**

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Project: Proposed Residence Hall						WAI Project No.: GJ1916425.000					
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY						Client: Stony Brook University					
Surface Elevation: ± 197.2 feet						Date Started: 8/14/2019		Water Depth Elevation (feet bgs) (feet)		Cave-In Depth Elevation (feet bgs) (feet)	
Termination Depth: 8.0 feet bgs						Date Completed: 8/14/2019					
Proposed Location: Building						Logged By: RL		During: NE --- ▼			
Drill / Test Method: HSA / SPT						Contractor: Tri-State		At Completion: NE --- ▼		At Completion: 8.0 189.2 	
						Equipment: Geoprobe		24 Hours: --- --- ▼		24 Hours: --- --- 	

SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS	
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0	TOPSOIL		3" Topsoil	Fine Grains Trace Roots Trace Gravel Content
0 - 2	S-1		2 - 2 - 2 - 2	12	4	0.3	GLACIAL DEPOSITS		Light Brown Poorly Graded Sand, Dry, Loose (SP)	
2 - 4	S-2		4 - 5 - 6 - 6	12	11				As Above, Medium Dense (SP)	
4 - 6	S-3		17 - 21 - 23 - 25	18	44	5.0			As Above, Dense (SP)	
6 - 8	S-4		18 - 17 - 24 - 26	12	41	8.0			As Above (SP)	Medium Gravel Content
						8.0	Boring Log B-6 Terminated at a Depth of 8.0 Feet Below Ground Surface Due to Auger Refusal; See Offset to B-6E			Attempted Offsets B-6A through B-6D; Shallow Refusal Less Than 2.0 fbgs
						10.0				
						15.0				
						20.0				
						25.0				

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-6E**

 Page 1 of 1

Project: Proposed Residence Hall						WAI Project No.: GJ1916425.000								
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY						Client: Stony Brook University								
Surface Elevation: ± 196.5 feet						Date Started: 8/20/2019			Water Depth Elevation (feet bgs) (feet)			Cave-In Depth Elevation (feet bgs) (feet)		
Termination Depth: 25.0 feet bgs						Date Completed: 8/20/2019								
Proposed Location: Building						Logged By: RL			During: --- --- ▼					
Drill / Test Method: HSA / SPT						Contractor: Tri-State			At Completion: --- --- ▼			At Completion: 9.0 187.5 		
						Equipment: Geoprobe			24 Hours: --- --- ▼			24 Hours: --- --- 		

SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0			
								Augered to 10.0 fbg	Offset from Boring B-6
						5.0			
						10.0			
10 - 11	S-1	X	41 - 50 - 50/0"	1	100/6"		GLACIAL DEPOSITS	Light Brown Poorly Graded Sand, Dry, Very Dense (SP)	Fine Grains
						15.0			
15 - 16	S-2	X	37 - 50 - 50/0	NR	100/6"			No Recovery, Presumed As Above (SP)	
						20.0			
20 - 22	S-3	X	18 - 15 - 13 - 20	6	28			As Above, Medium Dense (SP)	Medium Grains High Gravel Content
						25.0			
23 - 25	S-4	X	16 - 20 - 23 - 25	10	43			As Above, Moist, Dense (SP)	Medium Gravel Content
								Boring Log B-6E Terminated at a Depth of 25.0 Feet Below Ground Surface	

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-7**

 Page 1 of 2

Project: Proposed Residence Hall		WAI Project No.: GJ1916425.000	
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY		Client: Stony Brook University	
Surface Elevation: ± 202.0 feet	Date Started: 8/15/2019	Water Depth Elevation (feet bgs) (feet)	Cave-In Depth Elevation (feet bgs) (feet)
Termination Depth: 50.0 feet bgs	Date Completed: 8/15/2019	During: NE --- ▼	At Completion: 17.0 185.0 ▼
Proposed Location: Building	Logged By: RL	24 Hours: --- --- ▼	24 Hours: --- --- ▼
Drill / Test Method: HSA / SPT	Contractor: Tri-State		
	Equipment: Geoprobe		

SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0	TOPSOIL	4" Topsoil	
0 - 2	S-1		2 - 2 - 2 - 2	12	4	0.3	GLACIAL DEPOSITS	Light Brown Silty Sand with Gravel, Loose, Dry (SM)	Fine Grains
2 - 4	S-2		3 - 4 - 6 - 6	12	10			As Above, Orange, Medium Dense (SM)	Trace Gravel Content
4 - 6	S-3		10 - 12 - 15 - 15	12	27	5.0		As Above, Gray to Light Brown, Slightly Moist (SM)	Trace Cobble
6 - 8	S-4		15 - 18 - 15 - 17	16	33			As Above, Dense (SM)	
8 - 8	S-5		50/0"	NR	50/0"			No Recovery, Presumed As Above (SM)	Spoon Refusal Hard Augering @ 8.0 fbs
10 - 11.6	S-6		55 - 50 - 50 - 50/1"	12	100	10.0		As Above, Dry, Very Dense (SM)	
15 - 16	S-7		55 - 50 - 50/0"	NR	100/6"	15.0		No Recovery, Presumed As Above (SM)	
20 - 22	S-8		17 - 21 - 25 - 20	4	46	20.0		Brown Poorly Graded Sand, Moist, Dense (SP)	Medium Grains Trace Gravel Content
						25.0			

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-7**

 Page 2 of 2

Project: Proposed Residence Hall		WAI Project No.: GJ1916425.000	
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY		Client: Stony Brook University	
Surface Elevation: ± 202.0 feet	Date Started: 8/15/2019	Water Depth Elevation (feet bgs) (feet)	Cave-In Depth Elevation (feet bgs) (feet)
Termination Depth: 50.0 feet bgs	Date Completed: 8/15/2019	During: NE --- ▼	At Completion: 17.0 185.0 ▼
Proposed Location: Building	Logged By: RL	At Completion: NE --- ▼	24 Hours: --- --- ▼
Drill / Test Method: HSA / SPT	Contractor: Tri-State	24 Hours: --- --- ▼	Equipment: Geoprobe



SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						25.0	GLACIAL DEPOSITS	<div></div>	Gray Poorly Graded Sand, Moist, Dense (SP)	Trace Gravel Content
25 - 27	S-9	X	18 - 16 - 15 - 18	18	31					
						30.0				
30 - 32	S-10	X	14 - 16 - 12 - 15	12	28					
						35.0				
35 - 37	S-11	X	20 - 24 - 19 - 18	8	43					
						40.0				
40 - 42	S-12	X	22 - 24 - 21 - 18	12	45					
						45.0				
45 - 47	S-13	X	18 - 21 - 25 - 27	8	46					
48 - 50	S-14	X	21 - 26 - 28 - 24	4	54					
						50.0				
									Boring Log B-7 Terminated at a Depth of 50.0 Feet Below Ground Surface	

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-8**

 Page 1 of 2

Project: Proposed Residence Hall		WAI Project No.: GJ1916425.000	
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY		Client: Stony Brook University	
Surface Elevation: ± 203.0 feet	Date Started: 8/13/2019	Water Depth Elevation (feet bgs) (feet)	Cave-In Depth Elevation (feet bgs) (feet)
Termination Depth: 50.0 feet bgs	Date Completed: 8/13/2019	During: --- --- ▼	At Completion: 11.0 187.7 
Proposed Location: Building	Logged By: RL	At Completion: --- --- ▼	24 Hours: --- --- ▼
Drill / Test Method: HSA / SPT	Contractor: Tri-State	24 Hours: --- --- ▼	24 Hours: --- --- 
	Equipment: Geoprobe		



SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0			
0 - 2	S-1	X	2 - 3 - 2 - 3	NR	5		GLACIAL DEPOSITS	No Recovery, Presumed as Below (SP)	
2 - 4	S-2	X	7 - 10 - 9 - 10	8	19			Light Brown Poorly Graded Sand, Dry, Medium Dense (SP)	Fine Grains Trace Roots Trace Cobble
4 - 6	S-3	X	13 - 17 - 21 - 19	6	38	5.0		As Above, Dense (SP)	Trace Gravel Content
6 - 8	S-4	X	15 - 18 - 22 - 24	8	40			As Above (SP)	Medium Gravel Content
						10.0			
10 - 12	S-5	X	27 - 33 - 35 - 30	8	68			As Above, Very Dense (SP)	Trace Gravel Content
						15.0			
15 - 17	S-6	X	21 - 18 - 25 - 20	4	43			As Above, Dense (SP)	High Gravel Content
						20.0			
20 - 22	S-7	X	17 - 15 - 16 - 14	2	31			As Above (SP)	
						25.0			


NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-8**

 Page 2 of 2

Project: Proposed Residence Hall			WAI Project No.: GJ1916425.000		
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY			Client: Stony Brook University		
Surface Elevation: ± 203.0 feet		Date Started: 8/15/2019		Water Depth Elevation (feet bgs) (feet)	
Termination Depth: 50.0 feet bgs		Date Completed: 8/15/2019		Cave-In Depth Elevation (feet bgs) (feet)	
Proposed Location: Building		Logged By: RL		During: --- --- ▼	
Drill / Test Method: HSA / SPT		Contractor: Tri-State		At Completion: --- --- ▼	
		Equipment: Geoprobe		24 Hours: --- --- ▼	
				At Completion: 11.0 192.0 	
				24 Hours: --- --- 	

SAMPLE INFORMATION						DEPTH (feet)	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N					
						25.0	GLACIAL DEPOSITS		Light Brown Poorly Graded Sand, Slightly Moist, Medium Dense (SP)	Trace Gravel Content
25 - 27	S-8	X	16 - 14 - 11 - 16	18	25					
						30.0				
30 - 32	S-9	X	15 - 19 - 17 - 15	15	32					
						35.0				
35 - 37	S-10	X	18 - 18 - 17 - 21	12	35					
						40.0				
40 - 42	S-11	X	15 - 17 - 13 - 15	12	30					
						45.0				
45 - 47	S-12	X	16 - 14 - 12 - 16	12	26					
48 - 50	S-13	X	14 - 21 - 17 - 14	12	38					
						50.0			Boring Log B-8 Terminated at a Depth of 50.0 Feet Below Ground Surface	












NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-10**

 Page 1 of 1

Project: Proposed Residence Hall		WAI Project No.: GJ1916425.000	
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY		Client: Stony Brook University	
Surface Elevation: ± 204.0 feet	Date Started: 8/20/2019	Water Depth Elevation (feet bgs) (feet)	Cave-In Depth Elevation (feet bgs) (feet)
Termination Depth: 25.0 feet bgs	Date Completed: 8/20/2019	During: NE --- ▼	At Completion: 12.0 192.0 ▼
Proposed Location: Building	Logged By: RL	At Completion: NE --- ▼	24 Hours: --- --- ▼
Drill / Test Method: HSA / SPT	Contractor: Tri-State	24 Hours: --- --- ▼	
	Equipment: Geoprobe		


SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0	TOPSOIL		3" Topsoil	
0 - 2	S-1		2 - 2 - 3 - 5	12	5	0.3	GLACIAL DEPOSITS		Light Brown Poorly Graded Sand, Dry, Loose (SP)	Fine Grains Trace Gravel Trace Roots
2 - 4	S-2		10 - 18 - 21 - 23	6	39				As Above, Dense (SP)	Medium Gravel Content
4 - 4.5	S-3		25 - 50/0"	2	50/0"				As Above, Very Dense (SP)	High Gravel Content
6 - 6	S-4		50/0"	NR	50/0"				No Recovery, Presumed As Above (SP)	Spoon Refusal
8 - 8	S-5		50/0"	NR	50/0"				No Recovery, Presumed As Above (SP)	
10 - 12	S-6		51 - 38 - 47 - 55	12	85				As Above (SP)	High Gravel Content
15 - 16.5	S-7		43 - 50 - 50 - 50/0"	12	100				As Above (SP)	
20 - 22	S-8		25 - 31 - 27 - 26	8	58				As Above (SP)	Medium Grains Medium Gravel Content
23 - 25	S-9		43 - 37 - 29 - 36	10	66				As Above, Slightly Moist (SP)	High Gravel Content
						25.0			Boring Log B-10 Terminated at a Depth of 25.0 Feet Below Ground Surface	

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-11**

 Page 1 of 4

Project: Proposed Residence Hall		WAI Project No.: GJ1916425.000	
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY		Client: Stony Brook University	
Surface Elevation: ± 202.7 feet	Date Started: 8/19/2019	Water Depth Elevation (feet bgs) (feet)	Cave-In Depth Elevation (feet bgs) (feet)
Termination Depth: 100.0 feet bgs	Date Completed: 8/19/2019	During: NE --- ▼	At Completion: 16.0 186.7 
Proposed Location: Building	Logged By: RL	At Completion: NE --- ▼	24 Hours: --- --- ▼
Drill / Test Method: HSA / SPT	Contractor: Tri-State	24 Hours: --- --- ▼	
Mud Rotary @ 12.0 fbgs	Equipment: Geoprobe		

SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0	TOPSOIL	4" Topsoil	
0 - 2	S-1	X	2 - 3 - 3 - 2	4	6	0.3	GLACIAL DEPOSITS	Light Brown Poorly Graded Sand, Dry, Loose (SP)	Fine Grains Trace Gravel Content
2 - 4	S-2	X	5 - 5 - 5 - 3	18	10			As Above, Medium Dense (SP)	Trace Gravel Content
						5.0			
5 - 7	S-3	X	19 - 44 - 45 - 40	12	89			As Above, Very Dense (SP)	High Gravel Content
						10.0			
10 - 12	S-4	X	21 - 23 - 26 - 25	12	49			As Above, Dense (SP)	High Gravel Content
						15.0			
15 - 17	S-5	X	50 - 40 - 49 - 26	2	89			As Above, Brown, Very Dense (SP)	Medium Grains High Gravel Content
						20.0			
20 - 22	S-6	X	14 - 17 - 22 - 27	8	39			As Above, Dense (SP)	High Gravel Content
						25.0			


NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-11**

 Page 2 of 4

Project: Proposed Residence Hall			WAI Project No.: GJ1916425.000		
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY			Client: Stony Brook University		
Surface Elevation: ± 202.7 feet		Date Started: 8/20/2019		Water Depth Elevation (feet bgs) (feet)	
Termination Depth: 100.0 feet bgs		Date Completed: 8/20/2019		Cave-In Depth Elevation (feet bgs) (feet)	
Proposed Location: Building Pad		Logged By: RL		During: NE --- ▼	
Drill / Test Method: HSA / SPT		Contractor: Tri-State		At Completion: NE --- ▼	
Mud Rotary @ 12.0 fbgs		Equipment: Geoprobe		24 Hours: --- --- ▼	
At Completion: 16.0 186.7			24 Hours: --- ---		



SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
25 - 27	S-7	X	15 - 18 - 19 - 18	8	37	25.0	GLACIAL DEPOSITS		Brown Poorly Graded Sand, Dense (SP)	High Gravel Content
30 - 32	S-8	X	14 - 16 - 16 - 15	6	32	30.0			As Above (SP)	Coarse Grains High Gravel Content
35 - 37	S-9	X	14 - 17 - 21 - 26	6	38	35.0			As Above (SP)	High Gravel Content
40 - 42	S-10	X	15 - 21 - 24 - 24	1	45	40.0			As Above (SP)	High Gravel Content
45 - 47	S-11	X	18 - 24 - 26 - 27	5	50	45.0			As Above, Very Dense (SP)	
						50.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-11**

 Page 3 of 4

Project: Proposed Residence Hall						WAI Project No.: GJ1916425.000								
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY						Client: Stony Brook University								
Surface Elevation: ± 202.7 feet						Date Started: 8/20/2019			Water Depth Elevation (feet bgs) (feet)			Cave-In Depth Elevation (feet bgs) (feet)		
Termination Depth: 100.0 feet bgs						Date Completed: 8/20/2019								
Proposed Location: Building Pad						Logged By: RL			During: NE --- ▼					
Drill / Test Method: HSA / SPT						Contractor: Tri-State			At Completion: NE --- ▼			At Completion: 16.0 186.7 		
Mud Rotary @ 12.0 fbgs						Equipment: Geoprobe			24 Hours: --- --- ▼			24 Hours: --- --- 		

SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						50.0	GLACIAL DEPOSITS		
50 - 52	S-12	X	23 - 25 - 28 - 31	2	53			Brown Poorly Graded Sand, Very Dense (SP)	High Gravel Content
						55.0			
55 - 57	S-13	X	28 - 32 - 36 - 38	6	68			As Above (SP)	High Gravel Content
						60.0			
						65.0			
65 - 65.8	S-14	X	50 - 50/3"	3	50/3"			As Above (SP)	
						70.0			
						75.0			

RECORD OF SUBSURFACE EXPLORATION

 Boring No.: **B-11**

 Page 4 of 4

Project: Proposed Residence Hall		WAI Project No.: GJ1916425.000	
Location: Tabler Drive; Stony Brook, Town of Brookhaven, Suffolk County, NY		Client: Stony Brook University	
Surface Elevation: ± 202.7 feet	Date Started: 8/20/2019	Water Depth Elevation (feet bgs) (feet)	Cave-In Depth Elevation (feet bgs) (feet)
Termination Depth: 100.0 feet bgs	Date Completed: 8/20/2019	During: NE --- ▼	At Completion: 16.0 186.7 ▼
Proposed Location: Building Pad	Logged By: RL	At Completion: NE --- ▼	24 Hours: --- --- ▼
Drill / Test Method: HSA / SPT	Contractor: Tri-State	24 Hours: --- --- ▼	
Drill / Test Method: Mud Rotary @ 12.0 fbgs	Equipment: Geoprobe		

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
75 - 77	S-15	X	31 - 33 - 38 - 42	12	71	75.0	GLACIAL DEPOSITS		Brown Poorly Graded Sand, Very Dense (SP)	
						80.0				
85 - 85	S-16	X	50/0	NR	50/0	85.0			No Recovery, Assumed As Above (SP)	
						90.0				
95 - 97	S-17	X	23 - 35 - 50 - 50	8	85	95.0			As Above, Light Brown (SP)	
						98.0				
98 - 100	S-18	X	25 - 30 - 30 - 26	2	60	100.0			As Above (SP)	
									Boring Log B-11 Terminated at a Depth of 100.0 Feet Below Ground Surface	

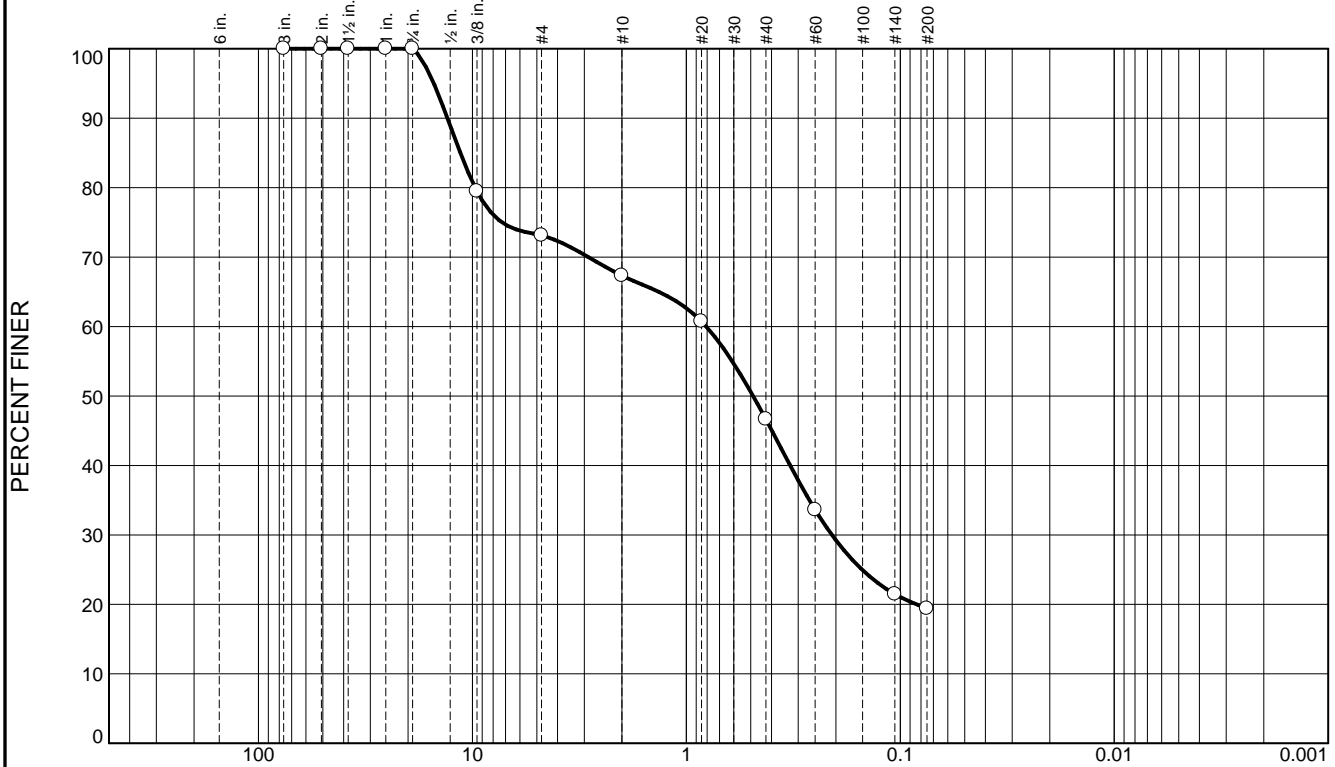
NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched



APPENDIX B

Laboratory Test Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	26.9	5.8	20.7	27.2	19.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	79.5		
#4	73.1		
#10	67.3		
#20	60.7		
#40	46.6		
#60	33.6		
#140	21.5		
#200	19.4		

* (no specification provided)

Material Description

Silty Sand with Gravel

Atterberg Limits

PL= NP

LL= NP

PI= NP

Coefficients

D₉₀= 13.0794

D₈₅= 11.3807

D₆₀= 0.8078

D₅₀= 0.4877

D₃₀= 0.2088

D₁₅=

D₁₀=

C_u=

C_c=

Classification

USCS= SM

AASHTO= A-1-b

Remarks

W_n = 7.3 %

Source of Sample: B-2
Sample Number: S-2

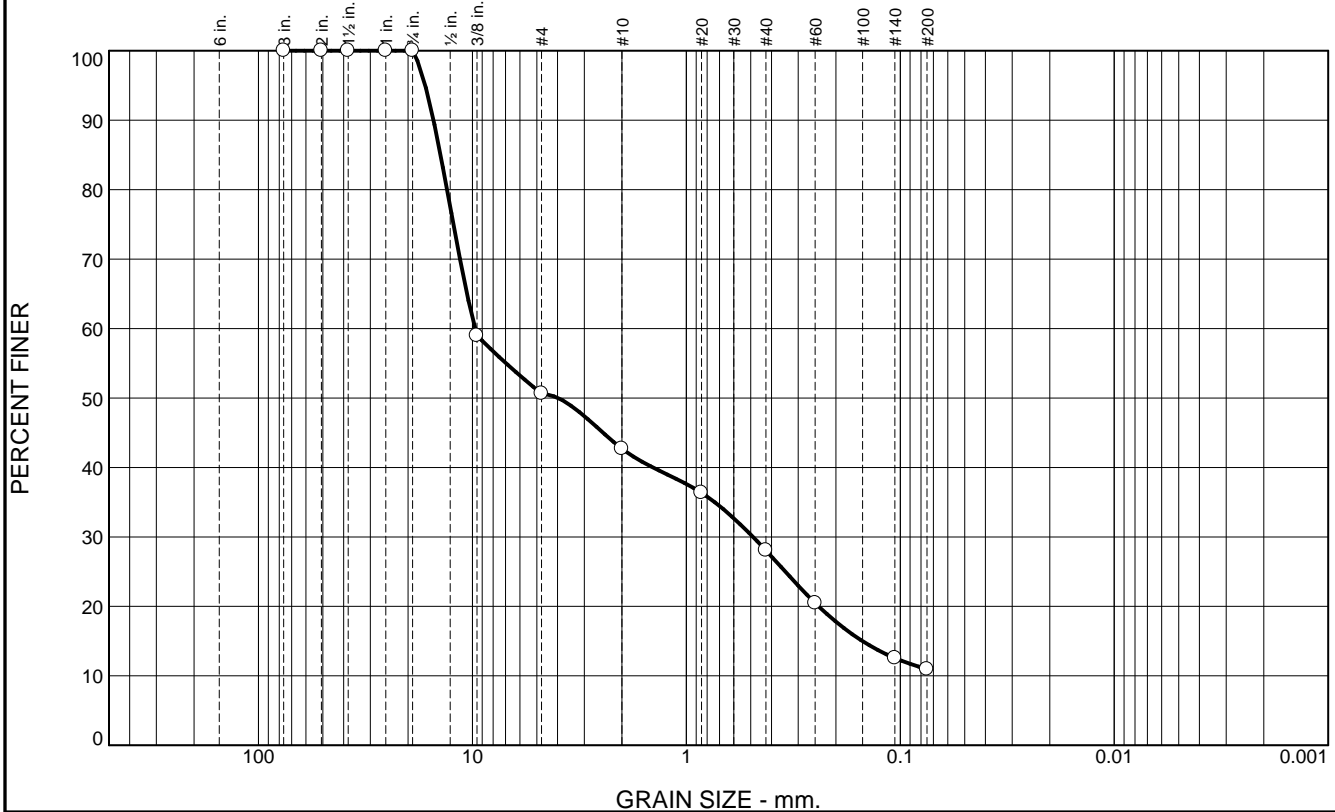
Depth: 2.0' - 4.0'

Date: 08/27/2019

**WHITESTONE
ASSOCIATES, INC.
Warren, New Jersey**

Client: Stony Brook University Campus Planning, Design & Construction
Project: Proposed Residence Hall
Tabler Dr, Stony Brook, Town of Brookhaven, Suffolk County, NY
Project No: GJ1916425.000
Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	49.4	7.9	14.6	17.1	11.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	59.0		
#4	50.6		
#10	42.7		
#20	36.3		
#40	28.1		
#60	20.5		
#140	12.6		
#200	11.0		

* (no specification provided)

Material Description

Poorly Graded Gravel with Silt and Sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D₉₀= 15.2066 D₈₅= 14.0964 D₆₀= 9.7209
D₅₀= 3.9803 D₃₀= 0.4881 D₁₅= 0.1501
D₁₀= C_u= C_c=

Classification

USCS= GP-GM AASHTO= A-1-a

Remarks

W_n = 1.8 %

Source of Sample: B-4B
Sample Number: S-2

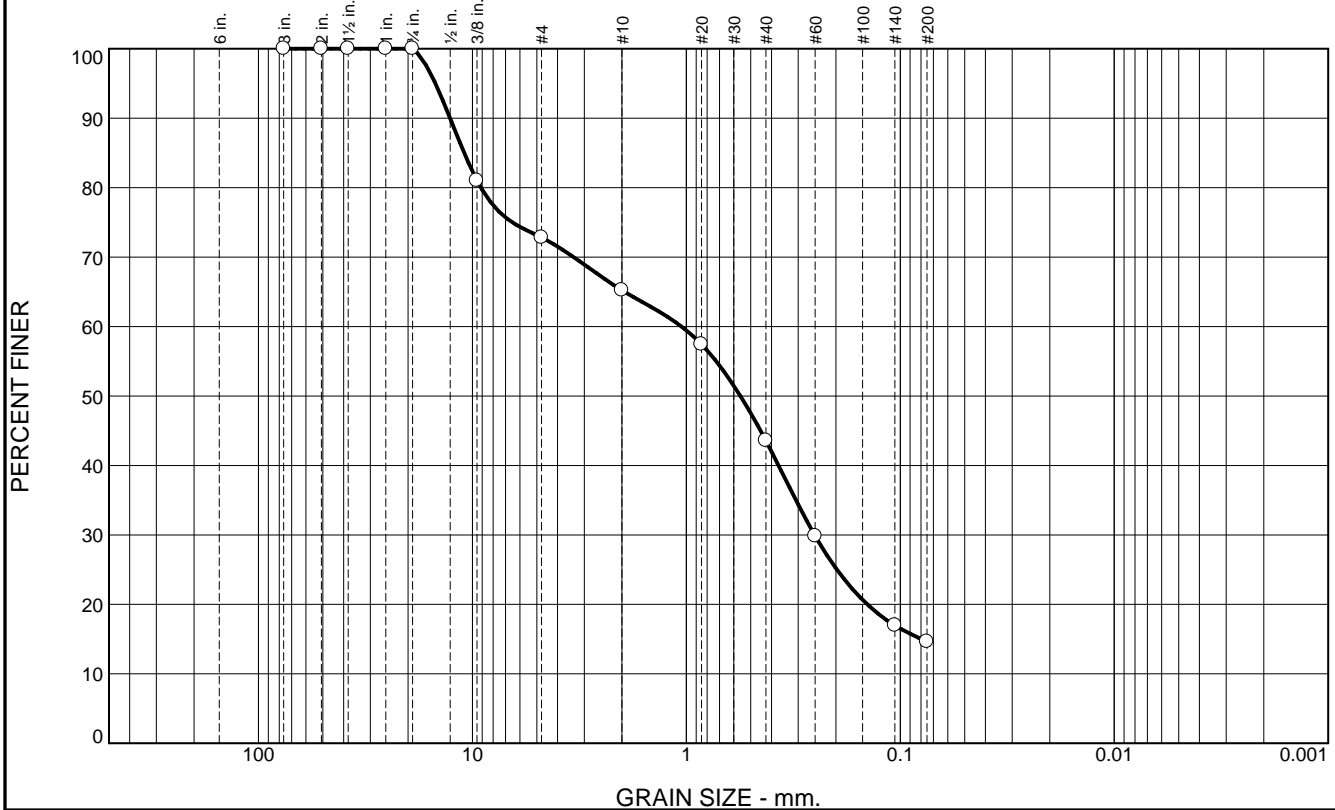
Depth: 8.0' - 10.0'

Date: 08/27/2019

**WHITESTONE
ASSOCIATES, INC.
Warren, New Jersey**

Client: Stony Brook University Campus Planning, Design & Construction
Project: Proposed Residence Hall
Tabler Dr, Stony Brook, Town of Brookhaven, Suffolk County, NY
Project No: GJ1916425.000 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	27.2	7.6	21.6	28.9	14.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	81.0		
#4	72.8		
#10	65.2		
#20	57.4		
#40	43.6		
#60	29.8		
#140	17.0		
#200	14.7		

* (no specification provided)

Material Description

Silty Sand with Gravel

Atterberg Limits

PL= NP

LL= NP

PI= NP

Coefficients

D₉₀= 12.7163

D₈₅= 10.9294

D₆₀= 1.0542

D₅₀= 0.5590

D₃₀= 0.2517

D₁₅= 0.0795

D₁₀=

C_u=

C_c=

Classification

USCS= SM

AASHTO= A-1-b

Remarks

W_n = 1.6 %

Source of Sample: B-5
Sample Number: S-3

Depth: 4.0' - 6.0'

Date: 08/27/2019

**WHITESTONE
ASSOCIATES, INC.
Warren, New Jersey**

Client: Stony Brook University Campus Planning, Design & Construction
Project: Proposed Residence Hall
Tabler Dr, Stony Brook, Town of Brookhaven, Suffolk County, NY
Project No: GJ1916425.000
Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	18.5	6.2	31.7	26.3	17.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	84.6		
#4	81.5		
#10	75.3		
#20	67.1		
#40	43.6		
#60	35.7		
#140	22.1		
#200	17.3		

* (no specification provided)

Material Description

Silty Sand with Gravel

Atterberg Limits

PL= NP

LL= NP

PI= NP

Coefficients

D₉₀= 11.9994

D₈₅= 9.7119

D₆₀= 0.6825

D₅₀= 0.5220

D₃₀= 0.1699

D₁₅=

D₁₀=

C_u=

C_c=

Classification

USCS= SM

AASHTO= A-1-b

Remarks

W_n = 2.1 %

Source of Sample: B-7
Sample Number: S-2

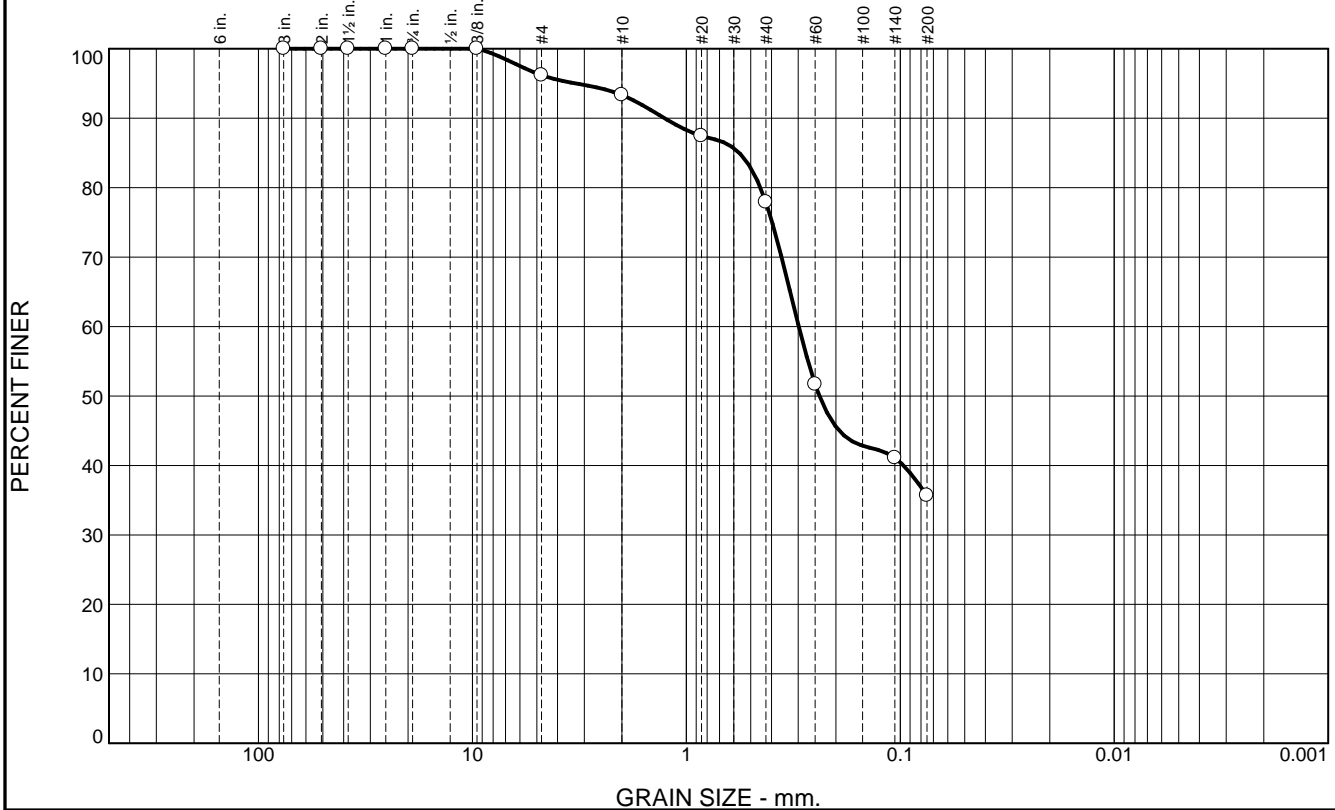
Depth: 2.0' - 4.0'

Date: 08/27/2019

**WHITESTONE
ASSOCIATES, INC.
Warren, New Jersey**

Client: Stony Brook University Campus Planning, Design & Construction
Project: Proposed Residence Hall
Tabler Dr, Stony Brook, Town of Brookhaven, Suffolk County, NY
Project No: GJ1916425.000
Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.8	2.9	15.4	42.2	35.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	96.2		
#10	93.3		
#20	87.4		
#40	77.9		
#60	51.7		
#140	41.1		
#200	35.7		

* (no specification provided)

Material Description		
Silty Sand		
<div> <div> Atterberg Limits PL= 17 LL= 18 PI= 1 </div> <div> Coefficients D₉₀= 1.2665 D₈₅= 0.5652 D₆₀= 0.2983 D₅₀= 0.2387 D₃₀= D₁₅= D₁₀= C_u= C_c= </div> <div> Classification USCS= SM AASHTO= A-4(0) </div> <div> Remarks W_n = 4.3 % </div> </div>		

Source of Sample: B-9 Depth: 0.0' - 2.0'
 Sample Number: S-1

Date: 08/27/2019

**WHITESTONE
ASSOCIATES, INC.
Warren, New Jersey**

Client: Stony Brook University Campus Planning, Design & Construction
Project: Proposed Residence Hall
 Tabler Dr, Stony Brook, Town of Brookhaven, Suffolk County, NY
Project No: GJ1916425.000 **Figure**

APPENDIX C

Infiltration Test Results



Test Hole No.: B-1 (offset)

Date: 8/20/2019

Weather: Clear

Field Engineer: R. Lombreglia

Test Depth Ft. Elev.:	5.0	200.0
--------------------------------	-----	-------

[illegible]

Field $i = 3.0$ in/hr

APPENDIX D

Supplemental Information (USCS, Terms & Symbols)

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION <u>RETAINED</u> ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		CLEAN SAND (LITTLE OR NO FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	MORE THAN 50% OF MATERIAL IS <u>LARGER</u> THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GC
MORE THAN 50% OF COARSE FRACTION <u>PASSING</u> NO. 4 SIEVE			SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SM	SILTY SANDS, SAND-SILT MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMITS <u>LESS</u> THAN 50	SC	CLAYEY SANDS, SAND-CLAY MIXTURES
	SILTS AND CLAYS	LIQUID LIMITS <u>GREATER</u> THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
MORE THAN 50% OF MATERIAL IS <u>SMALLER</u> THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	HIGHLY ORGANIC SOILS		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS FOR SAMPLES WITH 5% TO 12% FINES

GRADATION*

% FINER BY WEIGHT

TRACE..... 1% TO 10%
LITTLE..... 10% TO 20%
SOME..... 20% TO 35%
AND..... 35% TO 50%

COMPACTNESS*

Sand and/or Gravel

RELATIVE DENSITY

LOOSE..... 0% TO 40%
MEDIUM DENSE.... 40% TO 70%
DENSE..... 70% TO 90%
VERY DENSE..... 90% TO 100%

CONSISTENCY*

Clay and/or Silt

RANGE OF SHEARING STRENGTH IN POUNDS PER SQUARE FOOT

VERY SOFT..... LESS THAN 250
SOFT..... 250 TO 500
MEDIUM..... 500 TO 1000
STIFF..... 1000 TO 2000
VERY STIFF..... 2000 TO 4000
HARD..... GREATER THAN 4000

* VALUES ARE FROM LABORATORY OR FIELD TEST DATA, WHERE APPLICABLE.
WHEN NO TESTING WAS PERFORMED, VALUES ARE ESTIMATED.

L:\Geotechnical Forms and References\Reports\USCSTRMSSYM NJ.docx

Other Office Locations:

CHALFONT, PA
215.712.2700

SOUTHBOROUGH, MA
508.485.0755

ROCKY HILL, CT
860.726.7889

WALL, NJ
732.592-2101

STERLING, VA
703.464.5858

EVERGREEN, CO
303.670.6905

GEOTECHNICAL TERMS AND SYMBOLS

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

- N: Standard Penetration Value: Blows per ft. of a 140 lb. hammer falling 30" on a 2" O.D. split-spoon.
 Qu: Unconfined compressive strength, TSF.
 Qp: Penetrometer value, unconfined compressive strength, TSF.
 Mc: Moisture content, %.
 LL: Liquid limit, %.
 PI: Plasticity index, %.
 δd: Natural dry density, PCF.
 ▽: Apparent groundwater level at time noted after completion of boring.

DRILLING AND SAMPLING SYMBOLS

- NE: Not Encountered (Groundwater was not encountered).
 SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
 ST: Shelby Tube - 3" O.D., except where noted.
 AU: Auger Sample.
 OB: Diamond Bit.
 CB: Carbide Bit
 WS: Washed Sample.

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

<u>Term (Non-Cohesive Soils)</u>	<u>Standard Penetration Resistance</u>
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

<u>Term (Cohesive Soils)</u>	<u>Qu (TSF)</u>
Very Soft	0 - 0.25
Soft	0.25 - 0.50
Firm (Medium)	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

PARTICLE SIZE

Boulders	8 in.+	Coarse Sand	5mm-0.6mm	Silt	0.074mm-0.005mm
Cobbles	8 in.-3 in.	Medium Sand	0.6mm-0.2mm	Clay	-0.005mm
Gravel	3 in.-5mm	Fine Sand	0.2mm-0.074mm		

L:\Geotechnical Forms and References\Reports\USCSTRMSSYM NJ.docx

Other Office Locations:

CHALFONT, PA
215.712.2700

SOUTHBOROUGH, MA
508.485.0755

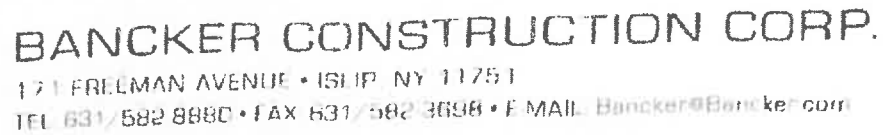
ROCKY HILL, CT
860.726.7889

WALL, NJ
732.592-2101

STERLING, VA
703.464.5858

EVERGREEN, CO
303.670.6905

Indicate B Hydrant WS2 Sprinkler _____ Other (Identify) _____



July 26, 2024

State purpose of test: REQUESTED

Flow hydrant #: W52 Location: TABLET BUILDING

GPM: 675

Remarks: _____

Indicate B Hydrant WS Sprinkler _____ Other (Identify) _____



BANCKER CONSTRUCTION CORP.

171 FREEMAN AVENUE • ISLIP, NY 11751

TEL: 631/582-8880 • FAX: 631/582-3698 • E-MAIL: Bancker@Bancker.com

Hydrant Flow Test Report

Test made by: NICK Time: 9/10/24 AM

Representative of: BANCKER.

Witness: FIRE MARSHAL ALSO (MARK ROSENBLUM)

State purpose of test: REQUESTED

Consumption rate during test: 750 G.P.M

If pumps affect test, indicate pumps operating: N/A

Flow hydrant #: 51 Location: TABLER.

Size Nozzle: 2.5"

Pitot Reading: 20 PSI

Discharge coefficient: .9 X Total GPM

GPM: 750

Static B 30 psi Residual B 28 psi

Projected results @ 20 psi Residual 1789 gpm: or @ psi Residual psi

Remarks:

Location map: Show line sizes and distance to next cross connected line. Show valves and hydrant branch size. Indicate North. Show flowing hydrants- Label A₁, A₂, A₃, A₄. Show location of static and residual- Label B

Indicate B Hydrant 52 Sprinkler Other (Identify)



BANCKER CONSTRUCTION CORP.

171 FREEMAN AVENUE • ISLIP, NY 11751

TEL: 631/582-8880 • FAX: 631/582-3698 • E-MAIL: Bancker@Bancker.com

Hydrant Flow Test Report

Test made by: NICK Time: 9/10/24 AM

Representative of: BANCKER.

Witness: FIRE MARSHAL ALSO (MARK ROSENBLUM)

State purpose of test: REQUESTED

Consumption rate during test: 839 G.P.M

If pumps affect test, indicate pumps operating: N/A

Flow hydrant #: 52 Location: TABLER.

Size Nozzle: 2.5"

Pitot Reading: 25 PSI

Discharge coefficient: .9 X Total GPM

GPM: 839

Static B 45 psi 2001 Residual B 40 psi

Projected results @ 20 psi Residual 2001 gpm: or @ 40 psi Residual 2001 psi

Remarks: _____

Location map: Show line sizes and distance to next cross connected line. Show valves and hydrant branch size. Indicate North. Show flowing hydrants- Label A₁, A₂, A₃, A₄. Show location of static and residual- Label B

Indicate B Hydrant #51 Sprinkler _____ Other (Identify) _____

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. Requests for Information (RFIs).
 - 3. Project Information Management (PIM) software.
 - 4. Project meetings.
- B. Related Requirements:
 - 1. Section 013115 "Coordination Drawings" for preparing coordination drawings.

1.2 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.
- B. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 INFORMATIONAL SUBMITTALS

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

1.4 GENERAL COORDINATION PROCEDURES

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

1.5 REQUESTS FOR INFORMATION (RFIs)

- A. Requests for Information (RFI's) are requests for clarifications or questions regarding the contract drawings and specifications, not contract terms, scheduling items, or general correspondence, nor, are they to be as a means to describe or request

approval of alternate construction means, methods or concepts or substitution for materials, systems means and methods.

1. Carefully study and compare the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, and prior Project correspondence and documentation prior to submitting a Request for Information.
- B. Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- C. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect
 6. Name of Construction Manager
 7. RFI number, numbered sequentially.
 8. RFI subject.
 9. Specification Section number and title and related paragraphs, as appropriate.
 10. Drawing number and detail references, as appropriate.
 11. Field dimensions and conditions, as appropriate.
 12. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 13. Contractor's signature.
 14. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- D. RFI Forms: Architect will furnish electronic version of form bound in Project Manual.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- E. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. Based upon the amount of RFI's received and their level of content, the Architect will establish the level of importance of each RFI and allow sufficient time in the Architect's professional judgment to permit adequate review.
 2. 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.
 3. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 4. 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 a change proposal according to the General Conditions of the Contract
 - a. If the Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 15 calendar days of receipt of the RFI response.
- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly; include the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
- G. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- 1.6 PROJECT INFORMATION MANAGEMENT (PIM) SITE
- A. Use Architect's Project Information Management (PIM) software transmission server software for purposes of hosting and managing project communication and documentation until Final Completion. Project Information Management (PIM) software site includes the following functions:
1. Project directory.
 2. Project correspondence.

3. Meeting minutes.
4. Contract modifications forms and logs.
5. RFI forms and logs.
6. Task and issue management.
7. Photo documentation.
8. Schedule and calendar management.
9. Submittals forms and logs.
10. Payment application forms.
11. Drawing and specification document hosting, viewing, and updating.
12. Online document collaboration.
13. Reminder and tracking functions.
14. Archiving functions.

- B. Architect will provide Project Information Management (PIM) software user licenses for use of the Owner, Contractor, Construction Manager, Architect, and Architect's consultants.
- C. The Architect utilizes Newforma Project Center Project Information Management (PIM) software to track submittals and RFI's.
- D. Post electronic submittals as PDF electronic files directly to Architect's Newforma Project Center server, specifically established for Project.

1.7 PROJECT MEETINGS

- A. General: Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 1. Attendees: Construction Manager will inform participants and others involved, and individuals whose presence is required, of date and time of each meeting, and will notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Construction Manager will prepare the meeting agenda and distribute the agenda to all invited attendees.
 3. Minutes: Construction Manager will record significant discussions and agreements achieved and distribute the meeting minutes to everyone concerned, including Owner, Construction Manager and Architect, within three days of the meeting.
- B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner, Construction Manager and Architect, but no later than 15 days after Notice to Proceed.
 - a. Attendees: Authorized representatives of Owner, Architect, and their consultants; Construction Manager; contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

- b. Agenda: Discuss items of significance that could affect progress, including the following:
 - 1) Tentative construction schedule.
 - 2) Phasing.
 - 3) Critical work sequencing.
 - 4) Designation of responsible personnel.
 - 5) Procedures for processing field decisions and Change Orders.
 - 6) Procedures for processing Applications for Payment.
 - 7) Distribution of the Contract Documents.
 - 8) Submittal procedures.
 - 9) Preparation of Record Documents
 - 10) Procedures for RFIs.
 - 11) Use of the premises and existing building.
 - 12) Work restrictions.
 - 13) Working hours.
 - 14) Owner's occupancy requirements.
 - 15) Procedures for moisture and mold control.
 - 16) Procedures for disruptions and shutdowns.
 - 17) Construction waste management and recycling.
 - 18) Parking availability.
 - 19) Office, work, and storage areas.
 - 20) Equipment deliveries and priorities.
 - 21) First aid.
 - 22) Progress cleaning.
 - 23) Responsibility for temporary facilities and controls.
 - 24) Security
 - 25) Meeting Disadvantaged Business Enterprises goals.
 - 2. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager and Owner's Project Inspector of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.

- f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Construction Manager will schedule and conduct a project closeout conference, at a time convenient to Owner, Construction Manager and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
- 1. Construction Manager will conduct the conference to review requirements and responsibilities related to Project closeout.
 - 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority; Architect, and their consultants; Construction Manager; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.

- e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Coordination of separate contracts.
 - k. Owner's partial occupancy requirements.
 - l. Installation of Owner's furniture, fixtures, and equipment.
 - m. Responsibility for removing temporary facilities and controls.
- 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Construction Manager will conduct progress meetings at bi-weekly or twice monthly intervals.
 - 1. Construction Manager will coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner, Construction Manager, Contractor and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site utilization.

- 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.
 - 15) Status of proposal requests.
 - 16) Pending changes.
 - 17) Status of Field Orders.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present, to others affected by decisions or actions resulting from each meeting and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

ATTACHMENT:

REQUEST FOR INFORMATION FORM

REQUEST FOR INFORMATION (RFI)

Contractor Address Phone: Fax		Architect: Page Southerland Page, Inc. Address Phone:	
Project Name & No: Tabler Quad New Residence Hall, Stony Brook University; 1018037.01		Project Location: Stony Brook, NY	
RFI Number: <div style="text-align: center; font-size: 1.2em;">1</div>	RFI Subject:	Date of Request:	Requested Date of Response:

☐ I have carefully studied and compared the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, and prior Project correspondence and documentation prior to submitting this Request for Information.

Sketches of Condition (Attach)	Spec Section: Page: Paragraph Ref.:	Drawing No. / Detail No.: Detail Ref.:
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Question or Information Needed

Contractor's Proposed Solution

Submitted By:

Architects Response:

Response By:

Date of Response :

1. Refer to Section 01 3100 "Project Management and Coordination" for RFI procedures.
2. Responses from the Architect do not change any requirements of the Contract Documents.
3. The information provided in this RFI is for clarification purposes only. It shall not be interpreted as a change order, nor an extension of time.
4. Failure to Notify the Architect within 15 days of receipt of the response to this RFI shall indicate that there is no cost or additional time associated with the response.

SECTION 01 3115 – COORDINATION DRAWINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes preparation of coordination drawings for architectural, structural, mechanical, plumbing, fire protection, fire alarm, lighting, information technology, security, and electrical Work.
- B. Related Sections include the following:
 - 1. Division 21, 22, 23, 26, 27 and 28 for additional requirements.

1.2 DEFINITION AND INTENT

- A. The Contract Drawings (mechanical, plumbing, electrical, and fire protection plans) are diagrammatic only and are not intended to show the alignment, exact physical locations, or configurations of such Work. Performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results. Where possible, the Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing coordination drawings.
- B. Coordination drawings are drawings prepared by Contractor that superimpose Work of multiple trades involved in the construction process. Coordination drawings indicate systems and components to be installed by the Contractor to maximize clear height and free area in ceiling cavities, allow for proper and adequate equipment service clearances, minimize space required by shafts and chases and provide the most efficient functioning and use of materials possible while complying with the final performance and finished appearance required by the Contract Documents.
- C. Coordination drawings are intended to show the relationship and integration of different construction elements that require coordination during fabrication or installation to fit in the space provided, to function as intended, and to present the intended final finished appearance.
- D. Coordination Drawings are not a replacement for shop drawings specified in the technical specifications or the Record Drawings required in Division 01.
- E. The Contractor shall manage the process so that each trade/ sub contractor provides all required information in a timely manner. Coordination Drawings may be completed on a phased basis so as not to delay the overall project schedule. The CPM Schedule specified elsewhere in Division 01 Section "General Requirements" shall include the submission of Coordination Drawings. The same shall demonstrate how the Contractor intends to integrate the submission of Coordination Drawings to suit the overall project schedule. The Contractor shall pay all costs for reproducing copies of coordination drawings for use in the field.

- F. Fully coordinated Ceiling Coordination Drawings must be received and approved by the Architect before any associated ceiling shop drawings of any trade will be reviewed.
- G. Sprinkler heads depicted on architectural drawings are intended to indicate design intent of layout only.

1.3 CONTRACTOR'S USE OF ARCHITECT'S BIM FILES

- A. Refer to Division 01 Section "Submittal Procedures" for availability of Architect's electronic background drawings, and required Electronic Data Transfer Agreement.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare and submit as informational submittal within 90 days of Notice to Proceed.
- B. Submit coordination drawings in the same manner as shop drawings; refer to Section 01 3300 Submittal Procedures.

1.5 PROJECT CONDITIONS

- A. Maintain marked up set of coordination drawings at Project site available for reference by Owner and Architect.
- B. Maintain original BIM model used to produce coordination drawings updated with revisions to reflect actual construction. Make drawing revisions at time of change to construction; Transfer information to BIM no later than every 15 days.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION OF COORDINATION DRAWINGS MODEL

- A. Produce all coordination drawings using Revit compatible Building Information Modeling (BIM).
 - 1. Utilizing the Architect's base model, each trade shall add their respective information to construct one comprehensive model integrating all trade models for the project.
 - 2. Each trade shall show their work in a different color on the RCPs, the above-ceiling drawings, and in other coordination drawings where the work has to be carefully coordinated.
 - 3. Architectural Work Information Required in the BIM Model:
 - a. Items which are recessed into ceilings and ceiling plenums, or surface mounted to ceilings.

- b. Anchorages, fastenings, and supporting for items recessed in, attached to, or suspended from ceilings or structure above ceilings.
 - c. Firewalls, Fire Barrier, Fire partitions and smoke partitions on coordination drawings for coordination of life safety requirements.
- 4. Plumbing Work Information Required in the BIM Model:
 - a. Sizes and bottom elevations of piping with insulation thickness included.
 - b. Dimensions of major components, such valves, access doors and cleanouts.
 - c. Fire-rated enclosures around piping
 - d. Support of all roof mounted plumbing piping and equipment.
 - e. Required space to install, service and maintain all plumbing mechanical items and systems.
- 5. HVAC Work Information Required in the BIM Model:
 - a. Sizes and bottom elevations of ductwork, piping with insulation thickness included.
 - b. Fire dampers.
 - c. Acoustical lining in ductwork.
 - d. Identification of ductwork pressure class.
 - e. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - f. Fire-rated enclosures around ductwork.
 - g. Support of all roof mounted HVAC piping and equipment.
 - h. Required space to install, service and maintain all HVAC items and systems.
- 6. Electrical Work Information Required in the BIM Model:
 - a. Electrical Work, including telecommunications, data, security, lighting and fire alarm systems.
 - b. Runs of vertical and horizontal conduit 1-1/4-inch diameter and larger.
 - c. Light fixture locations.
 - d. Emergency egress light locations.
 - e. Smoke detector, and other fire alarm device locations.
 - f. Panelboard, switchboard, transformer, cable tray, and motor control center, and exit signs.
 - g. Location of pull boxes and junction boxes, dimensioned from column center lines.
 - h. Bottom elevation of all conduit runs 1-1/4 -inch diameter and larger and of all cable trays.
 - i. Support of all roof mounted conduit and photovoltaic equipment, cameras, and security system devices.
 - j. Required space to install, service and maintain all electrical items and systems.
 - k. Lightning protection.
- 7. Fire Protection System Information Required in the BIM Model:

- a. Locations of standpipes, valves, mains piping, branch lines, pipe drops, and sprinkler heads.
 - b. Bottom elevation of main and branch lines.
8. Structural Work Information Required in the BIM Model:
- a. Ceiling system.
 - b. Openings and sleeve locations required in slabs, walls, beams and other structural elements, including required openings not indicated on Contract Documents.
 - c. Slab edge locations and locations of sleeves dimensioned from building lines and floor lines.
9. Ceiling Systems and Plenum Space in the BIM Model:
- a. For mechanical, plumbing, fire protection, fire alarm, electrical, controls, and telecommunications Work penetrating acoustical ceilings, show locations of each item (including sprinkler heads, diffusers, grilles, access doors, light fixtures, smoke detectors, exit signs, speakers, and other visible ceiling mounted devices) relative to acoustical ceiling grid or to wall in gypsum board ceilings.
 - b. Locate components within ceiling plenums to maximize clear area for future installations of lights and equipment.
 - c. Clearly indicate areas of conflict between light fixtures, diffusers and grilles and plenum boxes and other components on coordination drawings.
 - d. Draw elements to dimensions appropriate for products to be installed. Use of symbols is not acceptable.

3.2 TRADE CONFLICTS

- A. Utilize clash detection software to indicate areas of conflicts and obstacles.
- 1. Utilize computerized clash detection to identify trade conflicts as well as clashes within each trade, until all trades conflicts are fully coordinated.
 - 2. The Contractor shall then have the trade(s) revise their respective BIM models to eliminate the collisions and interferences.
 - 3. Contractor and each trade Contractor shall approve the Coordination drawings in writing indicating approval of installation coordination and clearances
- B. Each trade Contractor shall determine that all work can be installed without interference.
- C. In the case of unresolved clash, the Contractor shall notify the Architect. The Architect will then suggest to the Contractor as to how to revise the BIM model to eliminate the interference.
- 1. Submit a clash report identifying all the clashes and conflicts between trade systems.

3.3 PREPARATION OF COORDINATION DRAWINGS

A. Organize coordination drawing submittals as follows:

1. Floor Plans and Reflected Ceiling Plans: Provide floor plans and reflected ceiling plans for all floors. Show architectural, structural, mechanical, plumbing, fire protection, fire alarm, electrical, and telecommunications elements on floor plans and reflected ceiling plans.
2. Equipment Rooms and Spaces: Provide large scale drawings for equipment rooms and spaces showing plans and elevations of mechanical, plumbing, fire protection, electrical, and telecommunications equipment.
3. Structural Penetrations: Provide coordination drawings for each floor indicating penetrations and openings required for all trades.
4. In public and occupied areas without scheduled finish ceilings, appearance is a major coordination factor. Reposition proposed locations of work after Coordination Drawing review by the Architect. Provide adjustments to the exact size, location and offsets of ducts, pipes, and conduit to achieve reasonable appearance objectives. Provide these adjustments as part of the Contract or notify the Architect immediately as to why the adjustment cannot be made.

B. Prepare coordination drawings to a scale of 1/4" = 1'- 0" or larger (1/2"= 1'-0" for mechanical room plans); detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Detail complex areas at larger scale than typical floor plans.
2. Use a common architectural layout as background.
3. Indicate ductwork, pipes with 6-inch diameter and greater, and conduits with 3-inch diameter and greater by double lines. Use single lines for smaller mechanical piping and all electrical conduits. Draw piping, ductwork, lighting fixtures, and cable trays in scale.
4. Circle and clearly note deviations from Contract Documents with reason for deviation stated.
5. Provide name of representative of each subcontractor whose Work is indicated on coordination drawings, verifying their review and approval that their Work has been coordinated with each other trade and with architectural and structural Work.

END OF SECTION 01 3115

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Division 01 – General Requirements.

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."
- C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 - 2. Allow sufficient processing time; as a minimum, as indicated in this Section.
 - 3. Initial Submittal: 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.
 - 4. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

5. Format: Arrange the following information in a tabular format:

- a. Scheduled date for first submittal.
- b. Specification Section number and title.
- c. Submittal category: Action; informational.
- d. Name of subcontractor.
- e. Description of the Work covered.
- f. Scheduled date for Architect's final release or approval.
- g. Scheduled date of fabrication.
- h. Scheduled dates for purchasing.
- i. Scheduled dates for installation.
- j. Activity or event number.

- B. Architect will review Submittal Schedule for concentrations, overloading and similar conflicts which will impact the Architect's ability to meet the schedule and propose revisions to the duration of processing time to the Contractor.
- C. No payment will be made to Contractor until complete Schedule of Submittals has been received and accepted by Owner and Architect.
- D. The Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals if the Contractor fails to submit a Submittal Schedule.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files:

1. Any request for digital data files shall be solely and exclusively for use related to this Project.
2. Building Information Modeling (BIM): At the Contractor's written request, electronic data files of the BIM Model will be available from the Architect as a convenience to the Contractor for use in preparing shop drawings and coordination drawings for this Project in accordance with the attached Electronic Data Transfer Agreement and following:
 - a. To the extent the Architect chooses to utilize BIM software, it shall be for the Architects use in developing the Instruments of Service.
 - b. BIM files were created by the Architect for the primary purpose of creating 2D contract documents. No implication is intended for any purpose beyond the production of 2D documents.
 - c. BIM Digital Data Files will be available to the contractor, subcontractor or supplier on written request to the Architect in accordance with this Section
3. AutoCAD: Digital Data Files of the Floor Plan Background Drawings in editable file format (AutoCAD) will not be made available.
4. Electronic Data Order Procedure:
 - a. Submit completed Electronic Data Order Form attached to this Section to the Architect's representative in .pdf format.

- b. The Architect's representative will complete the Waiver, Release, and Indemnity Agreement for Electronic Documents Forwarded to Contractor, in the form attached to this Section, and send it to the requesting entity for signature.
 - c. The requesting entity shall sign the Agreement and return it to the Architect in .pdf format.
 5. Each contractor, subcontractor, trade, supplier or entity requesting electronic data file shall submit a request for Electronic Data Files, and shall sign and return the Waiver, Release, and Indemnity Agreement for Electronic Documents Forwarded to Contractor prior to delivery of said files. No contractor, subcontractor, trade, supplier or entity shall transfer these Electronic Files received from the Architect, or any portion thereof to any third party ("Transferee") without written permission of the Architect.
 6. The Architect will transfer files to the requesting entity via the Project Information Management (PIM) software.
 7. All files are a schematic representation of elements within the project. All Contractors are responsible for field verification and coordination with other trades.
 8. Use of these files does not relieve the Contractor from producing Coordination Drawings and Shop Drawings required by the Contract.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow sufficient 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 a minimum of 15 working 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 a minimum of 15 working 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 a minimum of 21 calendar days for initial review of each submittal. Any sequential reviews shall be identified on the Submittal Schedule by the Architect and agreed upon by the Project team.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Place fully executed "Submittal Cover Sheet" attached to the end of this Section as first page of every paper submittal.
 3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Name of subcontractor.
 - f. Name of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.
4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect .
5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Contractor.
 - a. Transmittal Form for Paper Submittals: Use form acceptable to Architect and Owner.
 - b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

- 1) Project name.
- 2) Date.
- 3) Destination (To:).
- 4) Source (From:).
- 5) Name and address of Architect.
- 6) Name of Contractor.
- 7) Name of firm or entity that prepared submittal.
- 8) Names of subcontractor, manufacturer, and supplier.
- 9) Category and type of submittal.
- 10) Submittal purpose and description.
- 11) Specification Section number and title.
- 12) Specification paragraph number or drawing designation and generic name for each of multiple items.
- 13) Drawing number and detail references, as appropriate.
- 14) Indication of full or partial submittal.
- 15) Remarks.
- 16) Signature of transmitter.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
3. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.

- n. Indication of full or partial submittal.
 - o. Submittal and transmittal distribution record.
 - p. Other necessary identification.
 - q. Remarks.
 - F. Options: Identify options requiring selection by Architect.
 - G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
 - H. Resubmittals: Make resubmittals in same form and manner as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
 - I. 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.
 - J. 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.
- 1.5 SUBMITTAL PROCEDURES
- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Post electronic submittals as one single PDF including submittal cover page electronic file directly to the Architect's project information transmission web based software "Newforma" as established for the Project.
 - a. Architect will return annotated PDF file via web based software "Newforma" to the Contractor. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Action Submittals: Submit electronic file except where paper copies of submittals are specifically required.
 - 3. Informational Submittals: Submit electronic file except where paper copies of submittals are specifically required.
 - 4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and

certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

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

- e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
- 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
- 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file, unless requested by Architect.
In addition to submission of electronic files, submit 3 paper copies of fire alarm shop drawings and sprinkler shop drawings with Contractor approval stamps applied, for submittal to the AHJ Code Review for review and comment.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 - 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 - 4. 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 three 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 variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Coordination Drawing Submittals: Comply with requirements specified in Section 013115 "Coordination Drawings."
- G. 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.
- H. 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.

- I. 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.
- J. 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.
- K. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- L. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- M. 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.
- N. 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.
- O. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- P. 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.
- Q. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- R. 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.

- S. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

1.6 DELEGATED-DESIGN SERVICES

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

PART 2 - EXECUTION

2.1 CONTRACTOR'S REVIEW

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

2.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Architect's Actions:

1. Contractor may proceed with fabrication on submittals marked "No Exception Taken" or "Make Corrections Noted" provided that the Contractor adheres to the corrections noted.
 2. Contractor may not proceed with fabrication on shop drawings noted "Revise and Resubmit" or "Rejected" until "No Exception Taken" or "Make Corrections Noted" stamp is received on resubmitted drawing.
 3. Contractor may not proceed with fabrication on the specific shop drawings noted "Partial Resubmit" until "No Exception Taken" or "Make Corrections Noted" stamp is received on resubmitted drawing.
 4. Do not permit submittals marked "Revise and Resubmit," or "Rejected," to be used at Project site, or elsewhere where Work is in progress.
 5. Other Action: Where submittal is primarily for information or record purposes, special processing or other activity, submittal will be returned, marked "No Action Taken."
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- F. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 01 3300

ATTACHMENTS:

- Submittal Cover Sheet
- Waiver, Release, and Indemnity Agreement for Electronic Documents Forwarded to Contractor
- Electronic Data Order Form

SUBMITTAL COVER SHEET

CONTRACTOR: _____
STREET ADDRESS: _____
CITY/STATE: _____
CONTRACTOR'S PROJECT NO: _____ SUBMITTAL NO: _____

DATE OF SUBMITTAL: _____ SUBCONTRACTOR: _____
SUBMITTAL DESCRIPTION: _____ RESUBMITTAL: ☐Y ☐N
SUBSTITUTION: ☐Y ☐N
SHOP DRAWING TITLE: _____

NO. _____ REVISION NO. _____ DATE: _____
PRODUCT DATA, TESTS, SCHEDULES: _____

SAMPLES: _____
MANUFACTURER: _____
ADDRESS: _____
REFERENCES: _____
SPECIFICATION SECTION - PAGE: _____ PARAGRAPH(S): _____
CONTRACT DRAWINGS(S): _____ ROOM NO.(S): _____

CONTRACTOR'S STAMP:

ARCHITECT'S STAMP:

REMARKS: _____

EXAMPLE ELECTRONIC DATA TRANSFER AGREEMENT

To: Whom it may concern

Re: Electronic Data Transfer Agreement for BIM Model and/or AutoCad drawings,
Between **Architect (Page Southerland Page Architects PC)** and **Contractor (Recipient of Files)**

Dear Sir or Madam:

By downloading the electronic files, you agree to the following:

Page Southerland Page Architects PC (“**Architect**”) will deliver to “**Contractor**” certain electronic files (such files and any and all drawings, models, data, and other information contained in the files are collectively referred to as the “Files”) for Contractor’s use in connection with the above project (“**Project**”), subject to the following terms and conditions.

These Files are components of the Architect’s Instrument of Service and not products. They are transmitted for the Owner’s benefit on this Project. Delivery of the Files to Contractor shall not be deemed to be a sale by Architect. Architect makes no representations or warranties whatsoever regarding the Files, including, without limitation, any representations or warranties of merchantability or fitness for any purpose. All rights to the Files, including all rights under the copyright and other laws, and the material objects in which the rights are embodied, are and shall be owned by the Architect. Transfer of the information does not transfer any license to use the underlying software or obligate the Architect to provide the software to the recipient. The Architect retains the right to reuse the information in the general course of a professional practice.

This Agreement provides the Contractor with a nonexclusive, limited license to use the information in the Files for the specific purpose of responding to the requirements of the Contract Documents for this Project. Except as necessary to respond to the requirements of the Contract Documents for this Project, Contractor shall not reproduce the Files or any portion thereof, create any derivations of the Files, or otherwise modify them. Receipt and use of the electronic data does not relieve the recipient of any responsibility or obligation. Contractor shall treat the information contained in the Files as proprietary and confidential. Contractor understands that protection of the information is of vital importance and shall maintain in confidence all such information and not use the information outside of the scope of the Project prior or subsequent to the duration of the Project.

The Files are not Contract Documents for the Project. Only hard copy documents are Contract Documents. If any discrepancies exist at any time between the Files and the Contract Documents the Contract Documents shall control.

Electronic documents may have minor “modelling conflicts” or “drafting conflicts” and it is the contractor’s responsibility to fully coordinate the systems and routing of same through a normal shop drawing and coordination drawing process.

The Contractor will only transfer the Files to Trade Contractors for their use and the use of their team. We understand that the contractor and sub-contractors will be using the model and/or AutoCad files for tasks including but not limited to building systems coordination.

The electronic files to be transferred to the Contractor include multiple model and/or AutoCad files. The Files are electronic source materials for the Contract Documents current as of the date of this correspondence. Architect shall transmit the Files to Contractor in electronic form as Revit (.rvt) and/or drawing (.dwg) format files current as of the last drawing distribution prior to this correspondence. Use of the electronic data is at the sole risk of the recipient, who acknowledges that the electronic data is subject to undetectable alteration or electronic corruption or degradation. Contractor waives any right to claims for detrimental reliance upon the information contained in the File.

Contractor acknowledges it has no contractual relationship with Architect or any relationship that is the functional equivalent of privity of contract, other than this letter agreement. Contractor shall hold Architect harmless from and against any and all losses, damages, costs, claims and any other liability relating directly or indirectly to the subject matter of this agreement. In no event shall Architect's liability exceed the amount of service fee payment made under this agreement.

The service fee is \$1 and is considered paid in full. This agreement shall be binding upon and inure to the benefit of the successors and assigns of the parties. Contractor shall not assign or otherwise transfer this agreement to any third party without the prior written consent of Architect.

Very truly yours,

Page Southerland Page Architects PC

Electronic Data Order Form

Date: _____

Project Name: _____

Project Number: _____

Recipient Name: _____

Recipient Address: _____

Recipient Telephone: _____ Recipient Fax: _____

Person Requesting
Electronic Data: _____

Signature: _____

I hereby request the following electronic data:

☐ **AutoCAD 2018 -
Background Drawings**

☐ **Revit 2023 - BIM
Model**

Electronic Data Order Form - Definitions

Editable File Format:

Editable file format electronic data can be altered by the Recipient. These electronic data will arrive in the format utilized by the Architect and indicated above.

Sheet Drawing:

An electronic document representing a hard copy drawing, which may be used to produce a drawing sheet

Bound:

All external references to an electronic document will be included into that electronic document, delivering it as a single electronic file.

Unbound:

All external references to an electronic document will be included as separate electronic files.

Background Drawing:

A. Floor plans including the following elements:

1. Exterior walls and openings in exterior walls at or below typical window or door height.
2. Interior walls and partitions and openings in interior walls and partitions at or below typical door height.
3. Glazed openings
4. Horizontal reference grid.
5. Toilet partitions and screens.
6. Cabinets, casework and countertops that are permanently installed.
7. Wall cabinets shown dotted.
8. Locations of elevators, dumbwaiters, escalators and chutes.
9. Stairs, landings, ramps, handrails and guards.
10. Plumbing fixtures visible within finished spaces.
11. Permanently mounted equipment in contact with the floor except Food Service Equipment.
12. Fixed seating.

B. Separate Reflected Ceiling Plans including the following elements:

1. Grid patterns for exposed grid ceilings
2. Tile patterns for acoustical tile ceilings
3. Ceiling bulkheads and soffits
4. Ceiling mounted Light fixtures
5. Fire suppression sprinkler heads
6. HVAC diffusers

SECTION 01 4339 – MOCKUPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes mockups for integrated systems and components which include products and materials, including the following:
 - 1. Specific room type mock-up
- B. Related Sections:
 - 1. Division 3 through 49 for additional mockups of individual products or components.

1.2 DEFINITIONS

- A. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; to demonstrate compliance with specified installation tolerances; to assess conformance with historic fabric and character; and for layout or design verification. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: For each mockup, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.
- B. Shop Drawings and Submittals for Materials: Provide those required for specific Division 02 through 49 specification Sections prior to starting mockup.
- C. Samples: Refer to specific Division 02 through 49 specification Sections.
- D. Mockup: Provide as many modifications to the mockup(s) as required to achieve Architect's and / or Owner's approval at no additional cost.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each product from the source supplying materials and products that are not part of the mock-up
- B. 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 as follows:
 - 1. Build mockups in location and of size indicated.
 - 2. Notify Architect fourteen days in advance of dates and times when mockups will be constructed.
 - 3. Provide schedule of construction, determine when specific subcontractor(s) will be on site, allow for site meetings throughout the process for problem solving and coordination
 - 4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction of the Project.
 - 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 6. Demolish, remove and reprepare portions of mock-up that have not been approved by Architect until Architect approves the mock-up.
 - 7. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 8. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 9. No work on building elements included in any mockup shall commence without Architect's written approval of relevant mockup
- C. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to constructing mockups.
 - 2. Review submittals and confirm understandings of markups, comments and actions associated with their review.
 - 3. Confirm schedule of mock-up construction with Owner, Architect, and related Contractors.
 - 4. Include all concerned parties, including subcontractors, manufacturer's representatives, and consultants, as required.

1.5 PROJECT CONDITIONS

- A. Do not install products or materials that are wet, moisture damaged, or mold damaged.

1.6 COORDINATION

- A. Coordinate construction of mockups to ensure timely approval and facilitate ordering of materials for incorporation in the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide materials, components, and products for mock-up as indicated on the Drawings and as specified in individual Specification Sections.
- B. All materials shall be new and purchased specifically for the project.

PART 3 - EXECUTION

3.1 GENERAL

- A. Approval of mockups is for visual characteristics of material and construction, and other qualities specifically and approved by Architect in writing.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected and resolved.
- B. See Drawings for extent, construction, and location of mock-up(s).
- C. Provide ongoing access to mockups (room, or other) during its construction and throughout the Project by Owner's additional Contractors/Forces, to allow for F.F.& E. mockups and installations; and for other uses requested.

3.2 ROOM MOCKUPS

- A. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished in accordance with requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. Provide room mockups of the following rooms:
 - 1. Provide mockup of a unit as indicated on the drawings.
- B. Mockup shall include a completely finished room.
- C. Timing: Complete mockup by the date indicated in the approved Project Schedule; if not included in Schedule, date as selected by Architect.
- D. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

3.3 PROTECTION

- A. Protect mockups from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

END OF SECTION 01 4339

SECTION 014533 - SPECIAL INSPECTIONS AND STRUCTURAL TESTING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Special Inspections and Structural Testing shall be in accordance with Chapter 17 of the *Building Code of New York State* (BCNYS).

1.2 DEFINITIONS

- A. Approved Agency: An established and recognized agency engaged by the Owner or the Owner's authorized agent to perform testing and inspections. The Approved Agency shall be regularly engaged in conducting tests, providing inspection services, and providing product certifications. The Approved Agency shall have equipment and personnel to conduct and evaluate tests and conduct Special Inspections on behalf of the Owner.
- B. Registered Design Professional in Responsible Charge (RDPRC): Professional Engineer or Registered Architect licensed in New York State, engaged by the Owner or the Owner's authorized agent to review, coordinate, and implement the Special Inspection program. The RDPRC may or may not be employed by the Approved Agency and need not be the Project SEOR.
- C. Special Inspector: A qualified person employed or retained by the Approved Agency, approved by the Code Enforcement Official as having the qualifications required to perform inspections.
- D. Structural Engineer of Record (SEOR): Registered Design Professional Engineer whose seal appears on the Contract Documents and is responsible for the preparation of the Schedule of Special Inspections.
- E. Geotechnical Engineer of Record (GEOR): Registered Design Professional Engineer whose seal appears on the Geotechnical Investigation. The GEOR shall perform or oversee Agent 2 services as indicated in the Schedule of Special Inspections. If a Geotechnical Investigation was not performed or if the GEOR is not retained to perform Agent 2 services, a licensed Geotechnical Engineer shall be retained by the Approved Agency to perform these duties.
- F. Code Enforcement Official: Officer or other designated authority charged with administration and enforcement of the BCNYS. For projects under jurisdiction of New York State agencies such as the Department of Education (SED), State University Construction Fund (SUCF), Office of General Services (OGS), and Dormitory Authority (DASNY), the Code Enforcement Official is an official from agency having jurisdiction.
- G. Statement of Special Inspections: Documents prepared by the SEOR and filed with and approved by the Code Enforcement Official, listing materials and work requiring Special Inspections. The Statement of Special Inspections is represented by this specification and includes the Schedule of Special Inspections.

- H. Schedule of Special: An itemized list of inspections, verifications, and tests (including frequency) required for the project, and the minimum qualifications of the Special Inspectors who will perform these services. The Schedule of Special Inspections is located on drawings S010 and S011.
- I. Inspect and Inspection: Visual observation of materials, equipment, or construction work as defined in the Statement of Special Inspections, to determine that the work is in substantial conformance with the requirements of the Contract Documents.
- J. Continuous Special Inspection: Full-time observation of work by the Special Inspector while the work is being performed.
- K. Periodic Special Inspections: Part-time or intermittent observation of work by the Special Inspector for work that has been or is being performed and at completion of work.

1.3 QUALIFICATIONS

- A. The Approved Agency and Special Inspectors shall be accepted by the RDPRC and the Code Enforcement Official.
- B. Special Inspections shall be performed by personnel who have relevant experience for each category of inspections indicated herein.
- C. Required minimum qualifications of Special Inspectors are indicated in this specification.

1.4 SUBMITTALS

- A. The Approved Agency shall submit to the RDPRC and Code Enforcement Official for review, a copy of their qualifications including names and qualifications of each Special Inspector who will be performing inspections or tests.
- B. The Approved Agency shall disclose past or current business relationships or potential conflicts of interest with Contractor or Subcontractors whose work will be inspected or tested.

1.5 PAYMENT

- A. Owner will engage and pay for services of RDPRC, Approved Agency, and the Special Inspectors.
- B. If materials requiring Special Inspections are fabricated in a plant not within 200 miles of project site, Contractor shall be responsible for travel expenses of Special Inspectors.
- C. Contractor shall be responsible for cost of retesting or reinspection of work failing to comply with requirements of Contract Documents.

1.6 OWNER RESPONSIBILITIES

- A. Owner will provide the RDPRC and Approved Agency with complete set of Contract Documents sealed by the SEOR and approved by the Code Enforcement Official.

1.7 CONTRACTOR RESPONSIBILITIES

- A. Contractor shall cooperate with the RDPRC, Approved Agency, and the Special Inspectors, so Special Inspections and testing may be performed without hindrance.
- B. As indicated in the Schedule of Special Inspections, Contractor shall notify the RDPRC and Approved Agency at least 48 hours in advance of a required inspection or test.
- C. Contractor shall provide incidental labor and facilities to provide access to work to be inspected or tested, to obtain and handle samples at site or at source of products to be tested, to facilitate tests and inspections, and for storing and curing of test samples.
- D. If Special Inspections or testing require the use of Contractor's scaffolding to access work areas, Contractor shall provide competent person to perform daily evaluation of scaffolding to verify it is safe to use. Contractor shall notify Special Inspectors of this review before each use. Contractor is responsible for safe assembly and stability of scaffolding.
- E. Contractor shall keep latest set of Construction Drawings, field sketches, accepted shop drawings, and specifications at project site for field use by Special Inspectors.
- F. Contractor shall perform remedial work if required and sign nonconformance reports stating remedial work has been completed. Contractor shall submit signed reports to the Approved Agency and RDPRC as work proceeds.
- G. The Special Inspection program shall not relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents or from implementing an effective Quality Control program.
- H. Contractor shall be solely responsible for construction site safety.

1.8 SPECIAL INSPECTOR RESPONSIBILITIES

- A. The RDPRC shall hold a Special Inspections preconstruction meeting at least 7 days prior to initial planned date for start of construction. Attendees shall include Contractors, Approved Agency, SEOR, and Project Architect. Discussions shall include the following:
 - 1. Review of specifications and Schedule of Special Inspections for work requiring Special Inspections.
 - 2. Responsibilities of Contractors, Owner, Approved Agency, Special Inspectors, and SEOR.
 - 3. Notification and reporting procedures.
- B. RDPRC shall record and distribute minutes from the Special Inspection Preconstruction meeting.

- C. RDPRC shall review inspection and material testing reports and coordinate the services of the Approved Agency as follows:
 - 1. Verify inspections have been performed in accordance with the Schedule of Special Inspections.
 - 2. Verify reports are being distributed to the Contractor, Owner, Architect, Code Enforcement Official, and SEOR.
 - 3. Verify discrepancies have been recorded and are being tracked.
- D. Special Inspectors shall make site visits to inspect work as designated in the Statement of Special Inspections. Discrepancies will be brought to the attention of the Contractor, RDPRC and SEOR.
- E. RDPRC shall keep records of inspections and tests.
- F. RDPRC shall review Certificates of Compliance for conformance with the standards specified in the Contract Documents. Discrepancies will be brought to the attention of the Contractor and SEOR.
- G. RDPRC shall submit a final report of Special Inspections in accordance with Section 3.4 of this specification.

1.9 LIMITS ON AUTHORITY

- A. RDPRC and Approved Agency shall not:
 - 1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Have control over Contractor's means and methods of construction.
 - 3. Be responsible for construction site safety.
 - 4. Have authority to stop work.

1.10 RECORDS AND REPORTS

- A. Prepare detailed reports of each test or inspection. Include the following general information:
 - 1. Project name and number.
 - 2. Date of test or inspection.
 - 3. Name of RDPRC and Approved Agency.
 - 4. Name of Special Inspector.
 - 5. Weather conditions.
 - 6. Locations and elevations of specific areas tested or inspected referenced to grid lines.
 - 7. Description of test or inspection.
 - 8. Reference to applicable ASTM standard.
 - 9. Summary of observations, results, and recommendations.
 - 10. Description of areas or materials requiring retesting or reinspection.

B. Concrete compressive strength test reports shall contain the following information:

1. Name of Contractor and concrete supplier.
2. Name of concrete testing service.
3. Name of Special Inspector making and testing specimens.
4. Truck number and delivery ticket number.
5. Date and location within structure of concrete placement.
6. Concrete type, class, mix proportions of materials, and design compressive strength at 28 days.
7. Slump, air content, unit weight, and concrete temperature.
8. Total time period between batching and completing placement for each truck.
9. Compressive strength and type of break for tests.

C. Field reports for concrete inspection shall contain general information noted above plus ambient temperature and cylinder numbers.

D. Test reports for masonry materials shall include proportions, composition, and compressive strength.

1.11 COMMUNICATION

A. Special Inspector shall immediately notify Contractor, RDPRC, Approved Agency, and SEOR by telephone, fax, or e-mail of test results failing to comply with requirements of Contract Documents.

B. Special Inspector shall immediately notify Contractor of work found to be in nonconformance with Contract Documents during inspections. If nonconforming work is not corrected while Special Inspector is on-site, Special Inspector shall notify RDPRC, Approved Agency, and SEOR within 24 hours (one business day) and issue an inspection report noting the non-conformance.

C. Approved Agency shall use a log to record and track non-conforming work during construction. Non-Conformance log shall include the following information:

1. Description of non-conformance.
2. Date of non-conformance.
3. Description of SEOR response if received.
4. Status of nonconformance: 'Open' or 'Closed.'

Updated log shall be submitted to the RDPRC, SEOR, and Architect on a weekly basis. Approved Agency may use Non-Conformance Log form provided at end of this section or other similar form.

D. If non-conforming work is not corrected at time of substantial completion of structure or other appropriate time, RDPRC shall notify Code Enforcement Official.

1.12 DISTRIBUTION OF REPORTS

- A. Approved Agency shall submit reports to RDPRC and SEOR within 7 days of inspection or test. Legible handwritten reports may be submitted if final typed copies are not available.
- B. RDPRC shall distribute reports to the Contractor, Owner, Architect, Code Enforcement Official, and SEOR within 7 days of inspections. Legible handwritten reports may be submitted if final typed copies are not available.
- C. If requested by the Code Enforcement Official, Approved Agency and RDPRC shall submit interim reports that include inspections and tests performed since beginning of construction or since previous interim report. Interim reports shall be addressed to the Code Enforcement Official with copies sent to the SEOR, Architect, and Contractor. Interim reports shall be signed by Special Inspector performing inspections.

1.13 FINAL REPORT OF SPECIAL INSPECTIONS

- A. At completion of work, each Approved Agency shall submit Agent's Final Report of Special Inspections to RDPRC stating work was completed in substantial conformance with Contract Documents and appropriate inspections and tests were performed. Approved Agency may use Agent's Final Report of Special Inspections form provided at end of this section or other similar form.
- B. At completion of work, RDPRC shall compile a Final Report of Special Inspections including each Agent's Final Report of Special Inspections. The Final Report of Special Inspections shall state required inspections have been performed and itemize nonconforming work not corrected or resolved as required by the BCNYS. Interim reports from all Special Inspectors will not be included unless specifically requested by the Owner or Code Enforcement Official. The Final Report shall be stamped by the RDPRC.
- C. RDPRC may use Final Report of Special Inspections form provided at end of this section or other similar form based on CASE Form 102-2001.
- D. RDPRC shall submit Final Report of Special Inspections to SEOR and Code Enforcement Official prior to issuance of a Certificate of Use and Occupancy.

PROJECT:

PROJECT NUMBER:

APPROVED AGENCY NON-CONFORMANCE

Non-Conformance Item No. (See Note 1)	Special Inspection Report No. Reference/Date	Summary of Non-Conformance	Date SEOR Response Received	Reinspection Required	Date Contractor Verification Received (See Note 1)	Status (See Note 2)
NC 1						
NC 2						
NC 3						
NC 4						
NC 5						
NC 6						

1. New items are in **bold**. For each non-conformance item above, the General Contractor or Subcontractor must sign and submit the Contractor Verification statement located in the RDP Response Report.
2. Non-conformance items remain “ OPEN” until the Contractor Verification have been received. When the signed verifications have been received by the RDP, the item will be “ CLOSED” .

Approved Agency's Final Report of Special Inspections

Project Name: _____ Approved Agency: _____

Location: _____ Approved Agency Project No.: _____

Owner: _____ Special Inspector: _____

Owner Address: _____ SEOR: _____

Ryan Biggs | Clark Davis Project No.: _____

To the best of my information, knowledge, and belief, the Special Inspections and testing required for this project and designated in the **Statement of Special Inspections** (which includes Specification Section **014533** and the Schedule of Special Inspections) have been performed and discovered discrepancies have been reported and resolved except for the following:

Comments:

[Attach continuation sheets if required to complete description of uncorrected discrepancies.]

Respectfully submitted,
Agent of the Approved Agency

(Type or print name)

Signature Date

Address

City, State, Zip

Final Report of Special Inspections

Project Name: _____ Approved Agency: _____

Location: _____ Approved Agency Project No.: _____

Owner: _____ Special Inspector: _____

Owner Address: _____ SEOR: _____

Ryan Biggs | Clark Davis Project No.: _____

To the best of my information, knowledge, and belief, Special Inspections required for this project, as indicated in the **Statement of Special Inspections**, (which includes Specification Section **014533** and the Schedule of Special Inspections) have been performed and discovered discrepancies have been reported and resolved except for the following:

Comments:

[Attach continuation sheets if required to complete description of uncorrected discrepancies.]

Interim reports submitted prior to this Final Report form a basis for and are to be considered an integral part of this Final Report. Upon request, the interim Testing and Special Inspection reports can be provided. Agent's Final Reports of Special Inspections are attached and are also a part of this Final Report.

Respectfully submitted,
Registered Design Professional in Responsible Charge

(Type or print name)

Signature

Date

Professional Seal

END OF SECTION 01 4533

SECTION 01 7419 – CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for Construction Waste Management (CWM), with criteria for recycling and/or salvaging demolition and construction waste generated during the project. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
 - 1. Waste Management Plan development and implementation.
 - 2. Techniques to minimize waste generation.
 - 3. Sorting and separating waste materials.
 - 4. Salvage of existing materials and items for reuse or resale.
 - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
 - 1. Soil.
 - 2. Inerts (eg, concrete, masonry and asphalt).
 - 3. Clean dimensional wood and palette wood.
 - 4. Green waste (biodegradable landscaping materials).
 - 5. Engineered wood products (plywood, particle board and I-joists, etc).
 - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
 - 7. Cardboard, paper and packaging.
 - 8. Bitumen roofing materials.
 - 9. Plastics (eg, ABS, PVC).
 - 10. Carpet and/or pad.
 - 11. Gypsum board.
 - 12. Insulation.
 - 13. Paint.

1.2 RELATED WORK

- A. Section 02 41 00, DEMOLITION.
- B. Section 018113, SUSTAINABLE DESIGN REQUIREMENTS.

1.3 PERFORMANCE REQUIREMENTS

- A. Prepare and submit a CWM Plan to the Design Professional for approval. The CWM Plan shall outline the provisions to be implemented to salvage for reuse or to recycle demolition and construction waste generated during the project.
 - 1. The end-of-project recycling rate when possible, shall equal, at minimum, 75 percent for (by weight) of the total waste from construction, demolition, and land clearing activities.
 - a. Contractors are encouraged to achieve higher levels of diversion from landfill, if possible, as this benefits long-term landfill management.
- B. The approved CWM Plan shall be implemented throughout the duration of the project and documented in accordance with the SUBMITTALS Article below.
- C. The CWM Plan shall include, but not be limited to, the following components:
 - 1. Re-Used materials/equipment: Materials or equipment to be removed from the site or turned over to the State shall be documented.
 - a. Documentation shall include the materials turned over, weight or quantity of materials/equipment and a letter on company letterhead indicating the intended use of items.
 - 2. Listing of Targeted Materials: Develop a list of the waste materials from the Project that will be targeted for reuse, salvage, or recycling. The following materials at minimum shall be accounted for (materials that will not be recycled shall be indicated as such):
 - a. Cardboard, paper, packaging
 - b. Acoustical Ceiling Tiles
 - c. Clean dimensional wood, palette wood
 - d. Beverage containers
 - e. Land clearing debris
 - f. Concrete
 - g. Stone
 - h. Concrete Masonry Units (CMU)
 - i. Asphalt
 - j. Metals from banding, stud trim, ductwork, piping, rebar, roofing,
 - k. windows, other trim, steel, iron, galvanized sheet steel, stainless
 - l. steel, aluminum, copper, zinc, lead, brass, and bronze
 - m. Gypsum board
 - n. Carpet and pad
 - o. Paint
 - p. Asphalt roofing shingles if applicable for any existing building
 - q. demolition
 - r. Rigid Foam
 - s. Glass
 - t. Plastics
 - u. Woods

3. Sorting Method: Provide a description of the means of sorting and transporting the recyclable materials (materials will be on-site sorted and then hauled to designated centers).
4. Recycling facilities: Provide the name of the recycling facilities(s) where materials will be sent for recycling, how it will be recycled, and the applicable fee(s).
5. Landfill Information: Provide the name of the landfill(s) where trash will be disposed of and the applicable landfill tipping fee(s).
6. Additional Information: Include any additional information deemed relevant to describe the scope and intent of the CWM Plan to the Design Professional.
7. Subcontractor Requirements: Construction Waste Management and recycling requirements shall be incorporated into all Subcontractors' contracts.

1.4 SUBMITTALS

A. Submittal Requirements:

1. Copy of the CWM Plan, as defined in the PERFORMANCE REQUIREMENTS Article above.
2. Contractors shall submit a monthly Waste Management submission.
 - a. This submission shall include waste receipts and a completed Waste Management Form. (a sample form is included at the end of this Section identified as Exhibit "A").
3. Calculations and supporting documentation to demonstrate end-of- project recycling rates meeting the requirements of the CWM Plan. Note: These calculations and supporting documentation are required regardless of method of processing (on-site or off-site separations). Use these Solid Waste Conversion Factors only if tipping tickets are not available if the weight in each dumpster or container is not directly measured.
Solid Weight Conversion Factors –
Mixed Waste 350 lbs/cubic yard
Wood 300 lbs/cubic yard
Cardboard 100 lbs/cubic yard
Gypsum Board 500 lbs/cubic yard
Rubble 1,400 lbs/cubic yard
Steel 1,000 lbs/cubic yard
 - a. Record and document the total weight (in tons) of all demolition and construction waste materials sent to the landfill or recycled or salvaged. Monthly Waste Management Reporting Forms shall be used as the basis for determining the total amount of waste recycled or salvaged for the project. The monthly reporting forms shall specify:
 1. The number of dumpsters or other containers of recycled or salvaged materials for that month.
 2. The volume (in cubic yards) of each dumpster or container of recycled or salvaged materials for that month.
 3. The type of recycled or salvaged material contained in each dumpster or container.
 4. The weight of the recycled or salvaged material in each dumpster or container. For materials not contained in the Solid Waste Conversion Factors above propose a conversion factor for review by the Design Professional.

5. In addition, provide the name of the receiving facilities/companies that will be purchasing or accepting the recycled or salvaged materials. Receipts or other proof of facility reception of materials is required.
6. For materials separated for recycling off-site, establish a method for tracking the weight of the recycled material. The method shall be included in the CWM Plan for the Design Professional review and approval.
- b. In the case of off-site separation, ensure the transfer station used will provide tickets with required information on delivery weights (or volume with appropriate conversions), and proof of recycling rates for reporting.
- c. Calculate the end-of-project recycling rate percentage by dividing the recycled and salvaged waste (in tons) by the total waste generated (recycled, salvaged, and landfilled waste – also in tons), and multiplying by 100.
- d. For materials turned over to others for reuse, provide documentation on company letterhead indicating the material(s), the quantity (either by weight or units), the date and the intended reuse of the product.

PART 2 - EXECUTION

2.1 IMPLEMENTATION

The following implementations of the CWM Plan will be the responsibility of either the Contractor for the Construction Work or the CWM Contractor if that work is bid out under separate contract.

- A. Containers: Provide containers and the removal of all waste, non-returned surplus materials, and rubbish from the site in accordance with the Waste Management Plan. Oversee and document the results of the Plan. The Prime Contractors shall be responsible for collecting, sorting, and depositing in designated areas their waste, non-returned surplus materials, and rubbish, as per the CWM Plan.
- B. Instruction: Provide on-site instruction of appropriate separation, handling and recycling, salvage, reuse and return methods to be used by all parties in appropriate stages of the project.
- C. Separation of materials: Recycling and waste bin areas are to be kept neat and clean, and clearly marked.
 1. On-site separation: Lay out a specific area(s) to facilitate separation of materials for potential recycling, salvage, reuse and return. Each potential material shall be collected and stored to avoid being mixed with other materials.

2.2 MEETINGS

- A. Conduct Construction Waste Management meetings. Meetings shall include Subcontractors affected by the CWM Plan. At a minimum, waste management goals and issues shall be discussed at the following meetings:

SECTION 01 8113 – SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

1. This section includes the construction waste management requirements necessary to comply with Executive Order 22

1.2 RELATED SECTIONS

- A. The following sections are related:

1. 01 74 19 Construction Waste Management

1.3 REFERENCES

- A. Additional requirements can be found:

1. Executive Order 22 (EO22)- <https://www.governor.ny.gov/executive-order/no-22-leading-example-directing-state-agencies-adopt-sustainability-and>
2. Embodied Carbon Guidance - https://ogs.ny.gov/system/files/documents/2023/08/eo22-embodied-carbon-guidance_aug-2023.pdf
3. FSC - Forest Stewardship Council - U.S., Washington, DC 20007, www.fscus.org.
4. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Chantilly, VA 20151, www.smacna.org.
5. ASHRAE: American Society of Heating Refrigeration and Air Conditioning Engineers, www.ashrae.org.

1.4 CONTRACTOR COORDINATION REQUIREMENTS

- A. Coordinate submittal and construction efforts.
- B. Designate a Sustainability representative responsible for:
 1. Attending Sustainability project meetings,
 2. Submitting and Coordinating submittals and contractor related documentation for EO22.
 3. Provide tracking materials and procedures necessary for EO22.
 4. Respond to questions and requests for additional information from Architect, Sustainability consultant and Campus Sustainability coordinator.
- C. Attend Contractor and Subcontractor training and coordination, specifically for EO22.
- D. Quarterly reporting and meetings (every 3 months): complete Material Tracking for Embodied carbon and Construction Waste diversion Table that includes cost

information in sortable excel format with back up info to support requirements; see appendix.

E. Workforce Development

1.5 SUBMITTALS

- A. Executive Order 22 Requirements- Project must meet the requirements of NYS Executive Order 22: Leading by Example: Directing State Agencies to Adopt a Sustainability and Decarbonization Program, including requirements for using approved green procurement specifications for all covered items, elimination of fossil-fuel equipment, calculation and reporting of embodied carbon, utilizing DEC's Value of Carbon Guidance for decision making, waste diversion, zero emissions vehicles transition, toxic use reduction, green infrastructure and sustainable landscaping per the Ecological Integrity Guidance, climate risk mitigation, and impact on disadvantaged communities.
- B. Sustainability Documentation Submittals: Product data, invoices, receipts, certification letters, Third-Party labels, Distance documentation, and Waste diversion and other documentation demonstrating compliance with specified requirements. Sustainability submittal requirements are in addition to other submittal requirements specified in the construction documents.
- C. Sustainability Submittal Requirements:
 - 1. For each product in the submittal include, as required, the following items, as applicable:
 - a. Product Material Cost
 - b. Third-party Label
 - c. Manufacturer's published product data
 - d. Product emissions testing results
 - e. Material Safety Data Sheets (MSDS)
 - 2. For all purchased salvaged products, provide the salvage location and receipts from the seller.
- D. Cover sheet with each submittal to mark which responsible material sourcing attributes apply to that product.
- E. Quarterly Reporting of tracking documents.

1.6 DEFINITIONS

- A. Authority Having Jurisdiction (AHJ): a federal, state, local or other regional authority having statutory authority over the project.
- B. Declare: a transparency platform and healthy materials advocacy tool. Declare includes a database of manufacturer reported materials with full ingredients disclosure.

- C. Embodied Carbon Footprint: carbon dioxide emissions created as a by- product of manufacturing, transporting, or disposing of a consumer product; a tool for calculating ecological footprint and environmental impact.
- D. FSC Wood: Certified to Forest Stewardship Council 100% labeling standards. Chain of Custody must be maintained from harvest through final product manufacturing, including millwork shop.
- E. Material Construction Budget: Total cost of all materials. Excludes labor, soft costs, and land.
- F. Material Cost: The total cost, not unit cost, of a material that has been manufactured and delivered for installation by a tradesman. Excludes labor, soft costs, and land.
- G. Volatile Organic Compounds (VOCs): Carbon compounds that participate in atmospheric photochemical reactions.
- H. Life Cycle analysis (LCA) - Life cycle analysis (LCA), also known as life cycle assessment, is a methodology that is used to measure the environmental impacts of a building, product, or process over the full life cycle of a product, building or process, from raw material extraction through end-of-life and disposal

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS SCOPE

- A. Construction team is required to track all permanently installed building products from Div 03-50, office systems furniture, task seating, all hardwired and hard-piped and with a dedicated electrical circuit or rated power of 22v or higher equipment and appliances and any construction related materials or equipment permanently installed.

2.2 RESPONSIBLE MATERIAL SOURCING

- A. Interior building products that have the potential to emit Volatile Organic Compounds are required to comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, or international equivalent.
 - 1. All products regulated by CDPH are required to comply.
- B. Environmental Product Declaration (EPDs)- EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 Environmental labels and declarations, ISO 14044 Environmental management – Life cycle assessment, and ISO 21930 Core rules for environmental product declarations of construction products and services
- C. Construction Waste Management: Divert 75% of construction waste material from landfill, see section 017419 Construction Waste management specifications. Surplus material if not needed, should be donated or sold, maintain receipt

- D. Embodied Carbon- The following guidelines are being issued for any construction projects the total project cost is over \$1 million, and 2) the minimum (or larger) quantities of at least one of the covered construction materials are used.

1. Covered Construction Materials and Minimum Quantities While all construction materials contain embodied carbon, the highest impact materials are those 1) with a high carbon footprint, 2) which are used in significant quantities on state projects, and 3) where reductions will result in the greatest GHG emissions reductions for state projects. For this reason, the GreenNY Council directs the Affected Entities to disclose embodied carbon that will result from projects utilizing the following materials if used in quantities above the stated thresholds:

Covered Construction Materials Table

<u>Covered Construction Material</u>	<u>Minimum quantity for disclosure (subject to change)⁴</u>
Concrete mixes	50 cubic yards or more
Asphalt mixes	16,854 pounds (or 10 cubic yards) or more
Steel	
i. Rebar	
ii. Hollow Structural Sections	20,000 pounds or more for rebar
iii. Fabricated Steel Plate	
iv. Hot-Rolled Sections	5,000 pounds or more, for all others (categories
v. Cold-Formed & Galvanized	ii – vi)
Glass	
i. Flat Glass	2,000 square feet or more
ii. Processed Glass	
iii. Insulated Glazing Units	

2. Disclosure of materials quantities and associated embodied carbon values For all applicable projects and materials, Affected Entities will be required to disclose: 1) quantities of covered construction materials, whether or not there is an EPD, 2) provide a link to the EPD, if one is available, 3) and if an EPD is available, provide the total GWP calculation (kg CO₂e) per used material or product (with the kgCO₂e factor from the EPD).
 - a. Embodied Carbon Disclosure: Contractors and designers shall be required to submit environmental product declarations (EPDs), if available, for all Covered Construction Materials used in this project under all circumstances
3. The contractor shall seek to reduce the embodied carbon of this project by specifying and selecting low carbon or carbon sequestering materials during procurement, through use of designs that reduce the needed quantity of carbon intensive materials, and/or by reusing existing materials and existing equipment.

PART 3 - EXECUTION

3.1 EO22 COMPLIANCE CONFIRMATION

- A. Prior to the commencement of construction, verify construction conditions are acceptable to achieve all EO22 requirements.

- B. All non-confirming conditions are to be documented and corrected prior to the commencement of work.

3.2 SITE OPERATION

- A. The construction site is to be 100% smoke free; Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.
- B. Executive Order 22 resources- including but not limited to all relevant specification sections, a copy of the EO22, EO22 Embodied Carbon Guidance, are to be available for reference onsite.

3.3 MEETINGS AND PROGRESS REPORTING

- A. The General Contractor is required to attend all construction sustainability progress meetings.
 - 1. Meetings will be Quarterly (every 3-months), Meeting schedule, time, and dates will be agreed upon at the commencement of construction.
- B. Prior to each meeting, the General Contractor is to provide the following items to the owner or owner's representative:
 - 1. Up-to-date submittal log and submittal schedule.
 - 2. Up-to-date Material Construction Budget with line item cost of each approved product.
 - 3. Construction Waste Management progress reports with hauler information and receipts.
 - 4. Construction IAQ plan and supporting information
 - 5. Quarterly reporting: complete Material Tracking Table that includes cost information in sortable excel format with back up info to support requirements.
 - 6. Construction activity pollution prevention (SWPP or other storm water management activities)
 - 7. Supporting documents for responsible materials attributes and low emitting materials for toxin prevention
- C. At the conclusion of the project, the General Contractor is to provide the following:
 - 1. A letter confirming that all EO22 responsibilities have been addressed.
- D. The General Contractor is to provide photo documentation of all systems that contribute to LBC performance but that are not visible for audit at the conclusion of construction (underground systems, for instance).

3.4 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

- A. All Contractors are to comply with the Construction Indoor Air Quality Management requirements and practices.

3.5 CONSTRUCTION WASTE MANAGEMENT

- A. All Contractors are to comply with the Construction Waste Management practices and requirements outlined in Section 01 74 19, "Construction Waste Management and Disposal."

END OF SECTION 017419

SECTION 01 8119 - SUSTAINABILITY IAQ MANAGEMENT

PART 1 - GENERAL

1.1 CONSTRUCTION IAQ MANGEMENT GOALS

- A. The Work of this Project shall minimize the detrimental impacts on Indoor Air Quality (IAQ) resulting from construction activities. The goal is to minimize factors that contaminate indoor air, such as, but not limited to: Dust entering HVAC systems and ductwork, improper storage of materials on-site, and poor housekeeping.
- B. Related Sections
 - 1. Division 01 Section "General Commissioning Requirements"

1.2 SUMMARY

- A. This Section includes requirements for the development of a Construction Indoor Air Quality Management Plan (IAQ Plan). The IAQ Plan shall be implemented throughout the duration of the project construction and shall be documented as outlined in the SUBMITTALS Article below. The IAQ Plan is part of the requirements for the project.
- B. The IAQ plan must be approved prior to start of work within the building envelope.
- C. Housekeeping procedures shall be implemented and followed by the Contractor and all Sub-contractors performing work related to the project. A regular housekeeping schedule will be instituted. Dust and debris will not be allowed to accumulate within the project area. Related Requirements:
 - 1. Section 018113 Sustainable Design Requirements

1.3 REFERENCES, RESOURCES

- A. "IAQ Guidelines for Occupied Buildings Under Construction", 2nd Edition, Chapter 3, November 2007, The Sheet Metal and Air Conditioner Contractors National Association (SMACNA). (703) 803-2980, www.smacna.org.
- B. ANSI/ASHRAE 52.2-1999, "Method of Testing General Ventilation Air- Cleaning Devices for Removal Efficiency by Particle Size", www.ashrae.org.

1.4 CONSTRUCTION IAQ MANAGEMENT PLAN

- A. Prepare and submit a Construction IAQ Management Plan approval. The Construction IAQ Management Plan shall meet the following criteria:
 - 1. Construction activities shall be planned to meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) "IAQ Guidelines for Occupied Buildings under Construction", Second Edition, 2007.

2. Absorptive materials shall be protected from moisture damage when stored on-site and after installation.
 3. If air handlers are to be used during construction, filtration with a Minimum Efficiency Reporting Value (MERV) of 8 must be at each return air grill, as determined by ASHRAE 52.2-1999.
 4. If air handlers are to be used during construction, specified pre and final filters must be installed. Filters within air handling systems utilized during construction (including building flush-out) shall be replaced with new specified filters immediately prior to TAB and occupancy.
 5. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE 52.2-1999.
 6. A "Sequence of Finish Installation Plan" shall be developed, highlighting measures to reduce the absorption of VOCs by materials that act as "sinks".
- B. Provide a Construction IAQ Management Plan During Construction: General IAQ Plan [within 7 days of construction commencement] outlining requirements during construction include:
1. HVAC protection.
 2. Source control.
 3. Pathway interruption.
 4. Housekeeping.
 5. Scheduling.
- HVAC Protection:
- a. Use of permanent heating, cooling, and ventilating systems during construction period is not permitted.
 - b. Comply with SCMACNA requirements for protection of air handling and distribution equipment and air supply and return ducting during construction.
 - c. Adequately cover and protect exposed air inlets and outlets, openings, grilles, ducts, plenums, as required to prevent water, moisture, and other contaminant intrusion.
 - d. Apply protection immediately after installation of equipment and ducting.
 - e. Ducting runs that require more than a single day to install shall be protected at the end of each day's work.
 - f. Replace air filtration media immediately prior to occupancy.
 - g. Pathway Interruption:
 - h. All openings within the designated work area shall be sealed while wet work is being performed to prevent contamination in adjacent areas.
 - i. Temporary ventilation shall be exhausted to the outside of the building.
- Housekeeping:
- a. Provide temporary ventilation during construction to minimize accumulation of dust fumes, vapors, or gases in the building.
 - b. Continuously ventilate during and after installation of materials that emit VOCs until emissions dissipate:
 1. Period after installation shall be sufficient to dissipate odors and elevated levels of VOCs. Provide temporary ventilation for one hour

- prior to, during, and for 24 hours after completion of installation of VOC emitting products.
- 2. Ventilate areas directly to outside, do not ventilate to other enclosed spaces.
- 3. Ventilate via open windows and temporary fans that provide no less than three air changes per hour.
- c. Use dust collection attachments on saws, sanders, and other power tools that generate dust particles.
 - a. Suppress dust with wetting agents or sweeping compounds.
 - b. Clean-up dust using a wet rag or damp mop.
 - c. Increase the cleaning frequency when dust build-up is noted.
 - d. Remove spills or excess applications of solvent-containing products as soon as possible.
 - e. Remove accumulated water and keep work areas as dry as possible.
 - f. Store and keep volatile liquid containers closed when the container is inside of the building and not in use.
 - g. HEPA vacuuming and duct cleaning.
 - 1. Vacuum carpeted and soft surfaces with a high efficiency particulate arrestor (HEPA) vacuum.
 - 2. If ducts contain dust and dirt, clean them using a HEPA vacuum immediately before substantial completion and prior to using the ducts to circulate air.
 - 3. Oil film on sheet metal should be removed before shipment to site. Ducts shall be inspected to confirm that no oil film is present. Remove oil that may be remaining.
 - h. Use nontoxic cleaning materials and procedures.

Scheduling:

- a. General: Comply with manufacturer's instructions for appropriate drying times.
- b. Protect installed absorbent materials with recycled or recyclable materials.
- c. Where odorous and/or high VOC-emitting products are applied on site, apply them before installation of porous and fibrous materials. Where this is not possible, protect porous materials with polyethylene vapor retarders.
- d. Ensure that wet applied interior finish materials, such as paints, adhesives, sealants, coatings, finishes, and spray-applied materials, such as structural fireproofing, are properly and fully cured before installing other finish materials over them.
- e. Install carpets and furnishings after all other interior finish materials have been applied and fully cured.
- f. Provide adequate ventilation of packaged dry products prior to installation. If space is available, remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues.

1.5 CONSTRUCTION IAQ MANAGEMENT PLAN BEFORE OCCUPANCY

Construction IAQ Plan Before Occupancy: Comply with the following requirements:

- A. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out.
- B. Keep operable windows and interior doors open and run HVAC system fan (or large portable commercial fan) continuously, or flush home with HVAC system fans and exhaust fans.
- C. Use additional temporary large portable commercial fans to circulate air within the house.
- D. Replace air filtration media immediately prior to occupancy

1.6 SUBMITTALS

- A. General: Create a Construction IAQ Plan, Coordinate IAQ submittals with other submittal requirements specified in the Technical Specification Sections, including material descriptions, product characteristics, and finishes; include IAQ data on furnished specialties and accessories. Documentation of ongoing Construction Indoor Air Quality Management practice described above.
- B. IAQ Product Data, General: For each type of material and product listed below that is used interior to the exterior waterproofing membrane, provide the following IAQ Product Data per low emitting limits outlined in SECTION 01 81 13.14018113.14 - SUSTAINABLE DESIGN REQUIREMENTS
- C. Moisture-Protection Plan: Contractor's plan describing procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Describe procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged work.
 - 3. Describe sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and concrete grinding. Describe plans for managing water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- D. Photos: Provide a minimum of 18 photographs comprising at least six photographs taken on three different occasions during construction. The photographs shall document the implementation of the Construction IAQ Management Plan throughout the course of the project construction. Examples include photographs of ductwork sealing and protection, temporary ventilation measures, and conditions of on-site materials storage (to prevent moisture damage). Photographs shall include integral date stamping and shall be submitted with brief descriptions of the Construction IAQ Management Plan measure documented or be referenced to project meeting minutes or similar project documents which reference to the Construction IAQ Management Plan measure documented.

1.7 QUALITY ASSURANCE

Coordination: Coordinate IAQ management activities with additional environmental requirements specified in Division 01 through Division 49 specification sections
Laboratory Test Requirements: Laboratory tests shall be performed by ISO/IEC 17025 accredited laboratories.

Third Party Certification and Verification Requirements: Certification and verification of environmental product claims shall be performed by ISO/IEC 17065 accredited certification bodies.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Products used on the project shall be as new, shall not have been exposed to water, and shall not have visible mold or mildew growth.
- B. Moisture Protection: Protect interior materials from water intrusion or penetration
- C. Comply with ventilation and testing requirements specified in Mechanical Technical Specification Sections, or as directed by Mechanical Engineer.
- D. Porous or fibrous materials with visible mold or mildew growth shall not be installed and shall be removed from the site and disposed of appropriately.
- E. Notify Owner and Architect immediately that mold or mildew is detected. Once discovered, no onsite or offsite treatment of mold and mildew with cleaning agents or other chemicals, including ozone, is permitted.
- F. Keep porous and organic materials from coming into prolonged contact with any concrete surface.
- G. Remove standing water from decks; keep deck openings covered to prevent water intrusion into the project.

1.9 PROJECT CONDITIONS

- A. Provide and maintain controlled interior environmental conditions in accordance with mechanical engineer's requirements before beginning installation of interior finish materials.
- B. Smoking shall not be permitted in indoor and outdoor Project site locations.
- C. Construction Ventilation and Preconditioning, General:
 - 1. Comply with ventilation and testing requirements specified in Mechanical Technical Specification Sections, or as directed by Mechanical Engineer.

2. Provide temporary ventilation for one hour prior to, during, and for 24 hours after completion of installation of interior products that emit vapors from organic solvents.

PART 2 - PRODUCTS

2.1 SUSTAINABLE PRODUCTS

- A. General: Products in this section may also be required to comply with sustainability requirements described in Sections 01 8113, 01 8113.01, and 01 8113.02 and 01 8116; including, but not limited to, the following:
 1. Energy Efficiency
 2. Water efficiency.
 3. VOC content.
 4. VOC emissions.
 5. Chemical content.
 6. Renewable or bio-based material content.
 7. Sustainable forestry.
 8. Life Cycle Analysis (LCA) or Durability
- B. Composite Wood and Agrifiber Products, Indoor Air Quality: Products shall comply with requirements specified in Section 01 8113.01.
- C. Wall and Ceiling Systems, Indoor Air Quality: Products shall comply with requirements specified in Section 01 8113.01.
- D. Flooring Systems, Indoor Air Quality: Products shall comply with requirements specified in Section 01 8113.01.
- E. Field-Applied Interior Paints and Coatings, Indoor Air Quality: Products shall comply with requirements specified in Section 01 8113.01

2.2 ADHESIVES, MASTICS, GLUES, AND SEALANTS

General: Do not use products that contain urea-formaldehyde.

VOC Limits: Products shall comply with requirements specified in Section 01 8113.01.

2.3 CLEANING AND PROTECTION, ENVIRONMENTAL ISSUES

- A. Cleaning Agents, General: Use cleaning products and agents recommended by or acceptable to manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that may damage finished surfaces. Preferentially to use cleaning agents with safer ingredients as defined by governmental or non-governmental programs.
- B. Final Cleaning, Environmental Issues: Use nontoxic cleaning and maintenance products as described in this Section.

- C. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces
- D. Clean equipment and fixtures to sanitary condition
- E. Remove and properly dispose of recyclable materials using a specified construction waste management program

2.4 PERFORMANCE REQUIREMENTS

- A. General: These requirements apply to interior building materials, products, and finishes located within the weatherproofing system, unless otherwise noted.
- B. Volatile Organic Compound (VOC) Emissions: Emissions for interior materials, products and finishes shall meet the California Department of Public Health (CDPH) Standard Method v1.1, 2010 requirements for modeled indoor air concentrations based on the private office scenario (Section 4.3.5).
Volatile Organic Compound (VOC) Content, Adhesives and Sealants: Site applied adhesives and sealants shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1168, Adhesive and Sealant Applications, amended January 5 2005.
Volatile Organic Compound (VOC) Content, Paints and Coatings: Site applied paints and coatings shall comply with one or both of the following:
 - 1. South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, amended September 6, 2013.
 - 2. California Air Resources Board (CARB) Suggested Control Measure (SCM) for Architectural Coatings, 2007.
 - 3. Composite Wood and Agrifiber Products for interior non-structural use:
 - 4. California: Composite wood products shall comply as No Added Formaldehyde (NAF) under California Air Resources Board (CARB) Airborne Toxic Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.). Note that product labels showing compliance are required for most composite wood and agrifiber products sold and used within the State of California but are optional in other jurisdictions. Labels should indicate products are NAF compliant.
 - 5. California (but not included under CARB ATCM): Products shall be produced using NAF resin binder.
 - 6. Outside of California: Products shall be produced using NAF resin binder.

2.5 PRODUCTS, GENERAL

General: These requirements are in addition to the performance requirements indicated above.

- A. Adhesives and Sealants:
 - 1. No adhesive and sealant shall contain formaldehyde or a formaldehyde precursor as an ingredient.

2. Silicone rubber caulks and sealants containing acetic acid as an ingredient only are permitted to be used in limited quantity in kitchen, bath and utility areas where it is necessary to obtain a water-tight seal.
3. SCAQMD Rule 1168: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with the following VOC content limits when calculated as required in Rule 1168 as amended January 2005, or most current version:
 - a. Wood Glues: 30 g/L
 - b. Metal-to-Metal Adhesives: 30 g/L.
 - c. Adhesives for Porous Materials (Except Wood): 50 g/L.
 - d. Subfloor Adhesives: 50 g/L.
 - e. Plastic Foam Adhesives: 50 g/L.
 - f. Carpet Adhesives: 50 g/L.
 - g. Carpet Pad Adhesives: 50 g/L.
 - h. VCT and Asphalt Tile Adhesives: 50 g/L.
 - i. Cove Base Adhesives: 50 g/L.
 - j. Gypsum Board and Panel Adhesives: 50 g/L.
 - k. Rubber Floor Adhesives: 60 g/L.
 - l. Ceramic Tile Adhesives: 65 g/L.
 - m. Multipurpose Construction Adhesives: 70 g/L
 - n. Fiberglass Adhesives: 80 g/L.
 - o. Contact Adhesive: 80 g/L.
 - p. Structural Glazing Adhesives: 100 g/L.
 - q. Wood Flooring Adhesive: 100 g/L.
 - r. Structural Wood Member Adhesive: 140 g/L.
 - s. Special-Purpose Contact Adhesive: 250 g/L.
 - t. Top and Trim Adhesive: 250 g/L.
 - u. Adhesive Primer for Plastic: 550 g/L.
 - v. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
 - w. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
 - x. Special-Purpose Aerosol Adhesive (All Types): 70 percent by weight.
 - y. Other Adhesives: 250 g/L
 - z. Architectural Sealants: 250 g/L.
 - aa. Other Sealants: 420 g/L.
 - bb. Sealant Primers for Nonporous Substrates: 250 g/L.
 - cc. Sealant Primers for Porous Substrates: 775 g/L.
 - dd. Other Sealant Primers: 750 g/L

B. Paints and Coatings:

1. No paint and coating shall contain formaldehyde as an ingredient or contain chemicals that react in the product to produce formaldehyde.
2. All finish coatings shall be formulated with water-based technologies (i.e., water-based polyurethane, acrylic/polyurethane, acrylic, UV, or polyester) with the exceptions that solvent-based wipe stains may be used as wood finishes and epoxy coatings may be used in small areas for specialty applications.
3. Paints and coatings applied to interior doors, casework and other components produced offsite shall comply with the requirements given below.

4. SCAQMD Rule 1113: For field applications that are inside the weatherproofing system, paints and coatings shall comply with the following VOC content limits when calculated as required in Rule 1113 as amended September 2013.
 - a. Flat Paints and Coatings: 50 g/L.
 - b. Non-flat Paints and Coatings: 150 g/L.
 - c. Primers, Sealers, and Undercoaters: 200 g/L.
 - d. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 - e. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 - f. Pretreatment Wash Primers: 420 g/L.
 - g. Clear Wood Finishes, Varnishes: 350 g/L.
 - h. Clear Wood Finishes, Lacquers: 550 g/L.
 - i. Floor Coatings: 100 g/L.
 - j. Shellacs, Clear: 730 g/L.
 - k. Shellacs, Pigmented: 550 g/L.
 - l. Stains: 250 g/L.
 5. CARB SCM, Table 1: For field applications that are inside the weatherproofing system, paints and coatings shall comply with the following VOC content limits when calculated as required by the SCM:
 - a. Flat Coatings: 50 g/L.
 - b. Non-flat Coatings: 100 g/L.
 - c. Non-flat – High Gloss Coatings: 150 g/L.
 - d. Wood Coatings: 275 g/L.
 - e. Floor Coatings: 100 g/L.
 - f. Primers, Sealers and Undercoaters: 100 g/L.
 - g. Stains: 250 g/L.
 - h. Concrete/Masonry Sealers: 100 g/L.
- C. Thermal and Acoustic Insulation, General:
1. Insulation material, including mineral/rock wool insulation, shall not contain formaldehyde-based binder as an ingredient.
 2. Insulation material shall be fire retardant free unless required by local building code
- D. Carpet and Carpet Cushion:
1. Comply with Carpet and Rug Institute (CRI) "Green Label Plus" program testing requirements for carpet and the "Green Label" program testing requirements for carpet cushion.
 2. ANSI/NSF 140: For carpet, meet Achievement Level of Gold, 52 to 70 points, based on specific Sustainable Attribute Performance for all product stages according to ANSI/NSF 140
- E. Resilient and Tile Flooring: Comply with Resilient Floor Covering Institute (RFCI) "FloorScore®" program testing requirements for flooring and flooring adhesives.
- F. Wood, Composite Wood, Agrifiber Products and Components: Manufactured, prefinished, and engineered wood products shall comply with indicated VOC requirements:

4. Moldings and Trim: Interior moldings and trim materials shall be solid wood or finger-jointed wood. No MDF or other composite wood products shall be used for moldings and trim.
5. Shelving and Panels: Built-in shelving, including closet shelving and organizers, and wood panels applied to walls, columns and other structures, shall consist of hardwood plywood (HWPW) with no-added formaldehyde (NAF) veneer core.
3. Stair Components: Stair components (handrails, balusters, posts, treads, risers and stringers) shall be solid wood. Alternately treads and risers may consist of hardwood plywood (HWPW) with NAF veneer core.
4. Built-In Casework, General:
 - a. Casework cases shall employ either solid wood or all plywood construction (APC) including end panels, ceilings, floors, backs, shelves and interior support beams.
 - b. Casework drawers shall consist of solid wood drawer sides and HWPW NAF drawer bottoms.
 - c. Casework interiors shall be finished wood veneer, high-pressure laminate or equivalent.
 - d. Finish coatings shall be water-based polyurethane, acrylic/polyurethane, acrylic, UV, or polyester. Finish coatings shall not contain or produce formaldehyde (i.e., acid cured or catalyzed finishes are prohibited)
5. Interior Doors, General: Preferred Option, interior doors shall be solid wood construction
6. Countertops General:
 - a. Kitchen, bath and utility countertops shall be concrete, stone, recycled paper composite, recycled plastic, terrazzo or other products that meet the specified VOC requirements of this Section.
 - b. Countertops shall be installed over substrates that are in compliance with the VOC requirements of this Section.
7. Gypsum board walls and ceilings, general:
 - a. Attachment Method: Paper-faced and paperless gypsum wall board (GWB) shall be applied with conventional mechanical fasteners. Solvent-containing adhesives shall not be used for application of gypsum board.
 - b. Gypsum board shall comply with VOC emissions testing as indicated in this Section.

PART 3 - EXECUTION

3.1 MOISTURE AND MOLD CONTROL

General: These requirements are in addition to the performance requirements indicated above.

- A. Do not load or install drywall, other porous materials and components, and items with high organic content into partially enclosed building.
- B. Keep interior spaces clean and protected from water damage; periodically collect and remove waste containing cellulose or other organic matter.

- C. Comply with manufacturer's written instructions for storage of products with respect to temperature, relative humidity, and water exposure limits.
- D. Document visible signs of mold and mildew that may appear during construction. Report findings in writing to Owner and Architect.

3.2 DESIGNATED IAQ REPRESENTATIVE

- A. The Contractor shall designate a representative with daily responsibility for IAQ issues. The designated IAQ representative is responsible for the implementation and adherence to the Construction IAQ Management Plan's goals and procedures. The designated representative shall:
 - 1. Regularly tour the jobsite to supervise and ensure IAQ Management Plan compliance. Keep written record of poor or failed compliance with the Construction IAQ Management Plan. Detail corrective actions taken to address all poor or failed compliance situations.
 - 2. Discuss ongoing measures to carry out the Construction IAQ Management Plan at project coordination meetings. Minutes shall be kept at these meetings for the Owner's records and for Plan documentation.
 - 3. Ensure that criteria for warnings and corrective actions due to poor or failed compliance with the Construction IAQ Management Plan are clearly understood.
 - 4. Notify the Owner or Owner's Representative if the procedures and measures required to implement the Construction IAQ Management Plan are not being adhered to.

3.3 CONSTRUCTION SITE MANAGEMENT

- A. If weather or plumbing leaks result in interior of building becoming wet:
 - 1. Ensure that building is properly dried out prior to installation of any additional materials into the space.
 - 2. Inspect installed materials for mold and mildew.
 - 3. Affected materials less than 10 square feet in area: Remediate materials according to accepted industry practices.
 - 4. Affected materials 10 square feet or more in area: Employ certified remediation firm to remove materials from site.
- B. For projects incorporating new construction in an existing space, follow the procedures outlined in the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, Chapter 3.

3.4 SCHEDULING AND PRODUCT INSTALLATION SEQUENCING

- A. Schedule shipment and delivery of products based on actual construction progress to minimize time products are stored on site.
- B. Prepare and staff building site for delivery of products.

- C. Inspect products upon delivery for conformance to Final Construction Materials List and to ensure that they are free from water and moisture damage and properly stored.
- D. Use the least practical amount of wet materials. Do not install dry materials until wet materials have been installed and allowed to dry to greatest extent practical.
- E. Choose drying time so that specified pollutant emission rates are achieved prior to installation of dry materials.
- F. Install solvent containing materials during periods during which building is unoccupied. Schedule installation as early as possible during construction to allow of maximum off-gassing prior to building occupancy or re-occupancy.
- G. Install high-VOC emitting products prior to the installation of porous or fibrous products, or protect with polyethylene sheeting, properly sealed.
- H. Complete installation of interior finishing materials two to four weeks prior to building flush-out.

3.5 CONSTRUCTION HVAC PROCEDURES

- A. Do not run HVAC system during course of construction. Seal ductwork intake and exhaust vents to prevent contamination from dust, moisture, and chemical contamination.
- B. Heat, dehumidify, and ventilate building during course of Work, conforming to provisions of Section 015000 – Temporary Facilities. Maintain environmental conditions suitable for drying and curing materials and for prevention of conditions suitable for mold and mildew growth.
 - 1. Ventilate building to remove moisture, dust, fumes, and odors.
 - 2. Temper and dehumidify air to remove excess moisture.
 - 3. Do not use propane heaters and other moisture generating heating systems.
 - 4. Do not use direct fired heaters inside the Building.
- C. Flush out Building including HVAC ductwork prior to Substantial Completion, and Owner occupancy. Coordinate with requirements below and with Section 019113, General Commissioning Requirements, and provisions of Division 23.
- D. Inspect ductwork for refuse, contaminants, moisture, and other foreign contamination prior to Commissioning. Notify Commissioning Agent of satisfactory inspection prior to beginning of Commissioning.

3.6 HOUSEKEEPING

- A. Regular housekeeping schedule will be instituted. The schedule shall include daily cleaning of work areas. Cleaning measures and frequency shall be selected according to the pollutants generated in a space.
- B. Under no circumstances will dust and debris be allowed to accumulate. Daily work area cleaning shall be implemented to prevent the accumulation of waste, dust and debris.
- C. No smoking, food, or drink is allowed in the active work area of the building. Break areas for food and drink only may be designated within the building or at a location outside the building. Smoking is not permitted
- D. Dust shall be suppressed by the use of low odor wetting agents, sweeping compounds, or HEPA vacuums.
- E. Spills of water or solvent will be cleaned up immediately.
- F. Particular attention shall be given to cleaning areas which will be concealed or hidden at the completion of construction. Such areas shall be cleaned completely prior to being completed. Such areas shall include, but are not limited to wall cavities, areas above drop ceilings, chases, and ledges

3.7 BUILDING FLUSH-OUT

- A. Following completion of interior finishes and installation of new furnishings, flush building with 100 percent clean outdoor air prior to occupancy.
- B. Flush-out shall be performed per IEQ Credit IAQ Management requirements.
- C. Building flush-out shall not expose spaces to excessive or insufficient temperature or humidity.
- D. HVAC system filters shall be replaced immediately prior to the flush-out sequence. New MERV 13 or better filters as specified for the HVAC system shall be utilized. HVAC system filters shall again be replaced at the completion of flush-out and prior to building occupancy.

END OF SECTION 01 8119

APPENDIX A – REFERENCES AND RESOURCES

REFERENCES AND RESOURCES

- A. Airborne Toxic Control Measure (ATCM) 93120-93120.12, Title 17, California Code of Regulations.
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
 - 1. ASHRAE Standard 52.2: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI Approved) for defining Minimum Efficiency Reporting Value (MERV).
 - a. Minimum efficiency Reporting Value (MERV) of 8 for filtration media.
 - b. Minimum efficiency Reporting Value (MERV) of 13 for filtration media.
 - 2. ASHRAE Standard 62.1: Ventilation for Acceptable Indoor Air Quality (ANSI Approved).
 - a. Sections 4 through 7.
 - b. Definition of minimum outdoor air rate.
 - 3. ASHRAE Standard 62.2: Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings.
- C. ASTM International (ASTM)
 - 1. ASTM D1356: Standard Terminology Relating to Sampling and Analysis of Atmospheres.
 - 2. ASTM D5116: Guide for Small Scale Environmental Chamber determination of Organic Emissions from Indoor Materials/Products.
 - 3. ASTM D5197: Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology).
 - 4. ASTM D6329: Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.
 - 5. ASTM D6345: Standard Guide for Selection of Methods for Active, Integrative Sampling of Volatile Organic Compounds in Air.
 - 6. ASTM D6670: Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products.
 - 7. ASTM D6886: Standard Test Method for Determination of the Individual Volatile Organic Compounds (VOCs) in Air-Dry Coatings by Gas Chromatography
 - 8. ASTM D7339: Standard Test Method for Determination of Volatile Organic Compounds Emitted from Carpet using a Specific Sorbent Tube and Thermal Desorption / Gas Chromatography.
 - 9. ASTM E2114: Standard Terminology for Sustainability Relative to the Performance of Buildings.
- D. Cal/EPA, California Air Resources Board (CARB)

1. Airborne Toxic Control Measure (ATCM) for formaldehyde in composite wood products: <http://www.arb.ca.gov/toxics/compwood/compwood.htm>
 2. Architectural and Industrial Coatings Program (AIM) – 2007 Suggested Control Measure (SCM), 2008: <http://www.arb.ca.gov/coatings/arch/docs.htm>
 3. Toxic Air Contaminants (TACs). Current version of list is accessible at <http://www.arb.ca.gov/toxics/id/taclist.htm>
- E. Cal/EPA, Office of Environmental Health Hazard Assessment (OEHHA)
1. Non-cancer health effects. Acute, 8-hour and Chronic Reference Exposure Levels (RELs). Current version of this list is accessible at <http://oehha.ca.gov/air/allrels.html>
 2. Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Current version of list is accessible at http://www.oehha.ca.gov/prop65/prop65_list/newlist.html
- F. CALGreen: 2013 California Green Building Standards Code, California Code of Regulations, Title 24, Part 11. Current version of code is accessible at <https://law.resource.org/pub/us/code/bsc.ca.gov/>
- G. California Department of Public Health (CDPH), CDPH/EHLB/Standard Method V1.1: Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1 (Emission Testing Method for California Specification 01350); accessible at <http://www.cal-iaq.org/separator/voc/standard-method>
- H. Carpet and Rug Institute (CRI): Green Label Plus Certification for carpet and carpet cushion; accessible at <http://www.carpet-rug.org/>
- I. Cradle to Cradle Products Innovation Institute: Cradle to Cradle (C2C) Certified Products Program; accessible at http://www.c2ccertified.org/product_certification/c2ccertified_product_standard
- J. Green Seal; accessible at <http://www.greenseal.org/FindGreenSealProductsAndServices.aspx>
1. Green Seal Standard GS-11, Paints and Coatings.
 2. Green Seal Standard GS-36, Adhesives for Commercial Use
 3. Green Seal Standard GS-42, Commercial and Institutional Cleaning Services.
 4. Green Seal Standard GS-49, Residential Cleaning Services.
- K. GreenScreen for Safer Chemicals: Method for chemical hazard assessment; accessible at <http://www.greenscreenchemicals.org/>
- L. Health Product Declaration Collaborative; Health Product Declaration (HPD) Standard Version 1.0; accessible at <http://hpdcollaborative.org>

- M. International Green Construction Code (IgCC); accessible at <http://www.iccsafe.org/CS/IGCC/Pages/default.aspx>
- N. Declare, The Ingredients Label for Building Products; accessible at www.declareproducts.com.
- O. International Organization for Standardization (ISO)
 - 1. ISO 14021:2001. Environmental labels and declarations. Self-declared environmental claims (Type II environmental labeling).
 - 2. ISO 16000-9:2006. Indoor Air - Part 9: Determination of the Emission of Volatile Organic Compounds from Building Products and Furnishing - Emission Test Chamber Method.
 - 3. ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories.
 - 4. ISO/IEC 17065: 2012 Conformity Assessment – Requirements for Bodies Certifying Products, Processes and Services
 - 5. ISO/IEC Guide 65:1996 General Requirements for Bodies Operating Product Certification Systems.
- P. North East Ozone Transport Commission (OTC)
 - 1. Model Rule 2009-12; Architectural & Industrial Maintenance (AIM) Coatings.
 - 2. Model Rule for Adhesives and Sealants.
- Q. Resilient Floor Covering Institute (RFCI): FloorScore emissions criteria and testing method for hard surface flooring and flooring adhesives; accessible at SCS Global Services website <http://www.scsglobalservices.com/floorscore>
- R. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).
- S. South Coast Air Quality Management District (SCAQMD)
 - 1. SCAQMD Rule 1113, Architectural Coatings: VOC limits for AIM paints and coatings; accessible at: <http://www.aqmd.gov/rules/reg/reg11/r1113.pdf>
 - 2. SCAQMD Rule 1168, Adhesive and Sealant Applications: VOC limits for primers, adhesives, sealants, and sealant and other primers; accessible at: <http://www.arb.ca.gov/drdb/sc/curhtml/r1168.pdf>
- T. US Environmental Protection Agency (EPA)

1. Indoor airPLUS Construction Specifications, Version 1 (Rev. 02):
<http://www.epa.gov/indoorairplus>
2. 40 CFR 59, Subpart D, Method 24, Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings;
accessible at <http://www.epa.gov/ttnemc01/promgate/m-24.pdf>
3. Building Radon Out (EPA 402-K-01-002): Building Radon Out: A Step-by-Step Guide On How to Build Radon-Resistant Homes, 2001; accessible at
<http://www.epa.gov/radon/pdfs/buildradonout.pdf>
4. Environmentally Preferable Purchasing Guidelines for Cleaning Agents; accessible
at <http://www.epa.gov/opptintr/epp/pubs/cleaning.htm>
5. Map of Radon Zones; accessible at <http://www.epa.gov/radon/zonemap.html>
6. Toxic Substances Control Act (TSCA), Section 5(b)(4): Chemicals of Concern;
accessible at <http://www.epa.gov/oppt/existingchemicals/index.html>

APPENDIX B –

DEFENITIONS

- A. Absorption: The process of one substance entering into the inner structure of another. (U.S. EPA).
- B. Absorptive Materials: Materials capable of absorption.
- C. Adsorption: The adhesion of a thin film of liquid or gases to the surface of a solid substance. (U.S. EPA).
- D. Air Change Rate: Ratio of volume of conditioned air brought into the emission test chamber or building space per unit time to the chamber or building space volume. (CDPH IAQ Standard Method V1.1, 2010).
- E. Allergen: A chemical or biological substance (e.g., pollen, animal dander, or house dust mite proteins) that induces an allergic state or reaction, characterized by hypersensitivity. A substance that induces allergic reaction. (US EPA, 2012).
- F. Annoyance: A general feeling of displeasure or adverse psychological reaction toward a source. Associated with disturbance, distress and frustration. (US EPA, 2012).
- G. ASHRAE: American Society of Heating, Refrigerating, and Air-Conditioning Engineers is an international group which is organized for the purpose of advancing the arts and sciences of heating, ventilation, air conditioning and refrigeration through research, standards writing, continuing education and publications. See www.ashrae.org. (US EPA, 2012).
- H. Asthma: A condition marked by recurrent attacks of difficult or labored breathing and wheezing resulting from spasmodic contraction and hypersecretion of the bronchi. It is caused by exposure to allergens such as drugs, foods, environmental pollutants, or intrinsic factors. (US EPA, 2012).
- I. ASTM International: American Society for Testing and Materials, a consensus-based standard setting organization. See www.astm.org. (US EPA, 2012).
- J. Breathing Zone: Area of a room in which occupants breathe as they stand, sit, or lie down. (US EPA, 2012).
- K. Building Flush Out: A process used to remove VOCs from a building by operating the building's HVAC system at 100 percent, tempered outside air for a specific period of time.
- L. Building-Related Illness (BRI): Diagnosable illness whose symptoms can be identified and whose cause can be directly attributed to airborne building pollutants (e.g., Legionnaire's disease, hypersensitivity pneumonitis). Also: A discrete, identifiable disease or illness that can be traced to a specific pollutant or source within a building. (Contrast with "Sick building syndrome"). (US EPA, 2012).

- M. Carcinogen: A substance that can cause or contribute to cancer. (US EPA, 2012).
- N. CDPH/EHLB/Standard Method V1.1: Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.1. Emission testing method for California Specification 01350. Supersedes previous version "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers". Prepared by Indoor Air Quality Section, Environmental Health laboratory Branch, Division of Environmental and Occupational Disease Control, California Department of Public Health. February, 2010.
- O. Concentration: Mass of VOC per unit air volume expressed at standardized conditions for temperature and pressure (i.e., 298° K, 101.3 kPa) (CDPH IAQ Standard Method V1.1, 2010).
- P. Contaminant: Any physical, chemical, biological, or radioactive substance that can adversely affect air, water or soil. (US EPA, 2012).
- Q. CREL – Noncancer chronic reference exposure level developed by Cal/EPA OEHHA. These are inhalation concentrations to which the general population, including sensitive individuals, may be exposed for long periods (10 years or more) without the likelihood of serious adverse systemic effects other than cancer. (CDPH IAQ Standard Method V1.1, 2010).
- R. Emission: Pollution discharge from a source. (US EPA, 2012).
- S. Emission Factor: Mass of VOC emitted from a specific unit area of product surface per unit time. Other unit measures such as product mass or length may be used as appropriate. (CDPH IAQ Standard Method V1.1, 2010).
- T. Emission Rate: Mass of VOC emitted by an entire product or test specimen per unit time. (CDPH IAQ Standard Method V1.1, 2010).
- U. Emission Test Chamber: Non-contaminating enclosure of defined volume with controlled environmental conditions for inlet air flow rate, temperature and humidity used for determination of VOC emissions from product test specimens. (CDPH IAQ Standard Method V1.1, 2010).
- V. EPA: United States Environmental Protection Agency.
- W. HEPA: High efficiency particulate arrestance (filters). (US EPA, 2012).
- X. Hypersensitivity: The immune system's exaggerated response to an allergen. (US EPA, 2012).
- Y. Hypersensitivity Diseases: Diseases characterized by allergic responses to animal antigens. The hypersensitivity diseases most clearly associated with indoor air quality are asthma, rhinitis, and hypersensitivity pneumonitis. Hypersensitivity pneumonitis is a

rare but serious disease that involves progressive lung damage as long as there is exposure to the causative agent. (US EPA, 2012).

- Z. IAQ Management Plan: A set of flexible and specific steps for preventing and resolving IAQ problems. (US EPA, 2012).
- AA. Indoor Air Quality (IAQ): As defined in ANSIASHRAE Standard 62.2, acceptable indoor air quality is "air towards which a substantial majority of occupants express no dissatisfaction with respect to odor and sensory irritation and in which there are not likely to be contaminants at concentrations that are known to pose a health risk."
- BB. Indoor Air Pollutant: Particles and dust, fibers, mists, bioaerosols, and gases or vapors. (US EPA, 2012).
- CC. Loading Factor: Ratio of the nominal exposed surface area of the product or the test specimen to the volume of the building space or the emission test chamber. (CDPH IAQ Standard Method V1.1, 2010).
- DD. Mutagen: Any substance that can cause a change in genetic material. (US EPA, 2012).
- EE. Mutagenic: Able to cause a permanent change in the structure of DNA. (US EPA, 2012).
- FF. Off-Gassing: The production of gases from the chemical deterioration of a substance over time, and the release of gases from materials into the air. (US EPA, 2012).
- GG. Organic Compounds: Chemicals that contain carbon. Volatile organic compounds vaporize at room temperature and pressure. They are found in many indoor sources, including many common household products and building materials. (US EPA, 2012).
- HH. Particulate Matter: A state of matter in which solid or liquid substances exist in the form of aggregated molecules or particles. Airborne particulate matter is typically in the size range of 0.01 to 100 micrometers. (US EPA, 2012).
- II. Preconditioning: A process of airing out building materials and furnishings to allow the VOCs to emit prior to installation in a building. The preconditioning of unwrapped materials and furnishings should be accomplished in a well ventilated space.
- JJ. Pressed Wood Products: A group of materials used in building and furniture construction that are made from wood veneers, particles, or fibers bonded together with an adhesive under heat and pressure. (US EPA, 2012).
- KK. Product Category: General group of similar products intended for a particular application and performance, such as vinyl composition tile (VCT), laminated wood flooring, broadloom carpet, sheet vinyl flooring, plywood, oriented strand board (OSB), interior paint, etc. (CDPH IAQ Standard Method V1.1, 2010).

- LL. Product Subcategory: Group of products within a product category having similar chemistry, construction, weight, formulation and manufacturing process and which may have a similar VOC emissions profile. (CDPH IAQ Standard Method V1.1, 2010).
- MM. Respirable Particles: Respirable particles are those that penetrate into and are deposited in the nonciliated portion of the lung. Particles greater than 10 micrometers aerodynamic diameter are not respirable. (US EPA, 2012).
- NN. Sick Building Syndrome (SBS): Term that refers to a set of symptoms that affect some number of building occupants during the time they spend in the building and diminish or go away during periods when they leave the building. SBS cannot be traced to specific pollutants or sources within the building. (Contrast with "Building related illness"). (US EPA, 2012).
- OO. Total Volatile Organic Compounds (TVOCs): Sum of the concentrations of all identified and unidentified VOCs between and including n-pentane through n-heptadecane (i.e., C5 – C17) as measured by the GC/MS TIC method and expressed as a toluene equivalent value. (CDPH IAQ Standard Method V1.1, 2010).
- PP. Toxic: Of, affected by, or caused by a toxin; to cause a poisonous reaction. (US EPA, 2012).
- QQ. Volatile: 1. Able to evaporate readily. 2. Able to go to gas phase from a liquid or solid phase. (US EPA, 2012).
- RR. Volatile Organic Compounds (VOCs): Compounds that vaporize (become a gas) at room temperature. Common sources which may emit VOCs into indoor air include housekeeping and maintenance products, and building and furnishing materials. In sufficient quantities, VOCs can cause eye, nose, and throat irritations, headaches, dizziness, visual disorders, memory impairment; some are known to cause cancer in animals; some are suspected of causing, or are known to cause, cancer in humans. At present, not much is known about what health effects occur at the levels of VOCs typically found in public and commercial buildings. (US EPA, 2012).
- SS. VOC Content: Volatile organic compound contained in the product.
- TT. VOC Emissions: Volatile organic compounds emitted by a product into the air.

SECTION 01 9107 - BUILDING ENCLOSURE COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Building Enclosure Commissioning is a systematic process of reviewing, testing and verifying that all building enclosure systems, perform interactively according to the Owner's operational needs, the design documents, manufacturer's recommendations, and good engineering, architectural and workmanship practices. This is achieved by beginning in the design phase and understanding the Owner's requirements, and continuing through construction, acceptance, and the warranty period with actual verification of performance.
- B. Building Enclosure Commissioning (BECx) is distinct from the mechanical, electrical and plumbing commissioning (Cx). BECx is the process by which the designed and constructed performance of building enclosure materials, components, assemblies, and systems are validated and documented to meet defined objectives and requirements of the project, as established by the Owner.
- C. This Section includes supplemental requirements for implementation of building enclosure commissioning of the components and assemblies of the building enclosure. This Section provides the requirements for the processes and responsibilities of BECx, while individual technical and equipment sections describe detailed requirements for quality assurance testing, preconstruction testing, mockups, submittals, pre-installation conferences, and field quality control for each division.
- D. The enclosure commissioning process does not take away from or reduce the responsibility of the system designers or the installers to provide a finished and fully functioning product.
- E. Abbreviations: The following are common abbreviations used in the Specifications. Definitions are found in Article 1.3.

A/E - Architects and Design Engineers	PC - Prime Contractor
BECxA - Building Enclosure Commissioning Authority	OPR - Owner's Project Requirements
CxA - Commissioning Authority (mechanical systems)	PM - Project Manager (of the Owner)
BOD - Basis of Design	
CTR - Enclosure Installers	BECA- Building Enclosure Commissioning Agent
BECx - Building Enclosure Commissioning	O&M - Operation & Maintenance Manual
BECx Plan - Building Enclosure Commissioning Plan Document	ITA - Independent Testing Agency

1.3 DEFINITIONS

- A. Refer to 019113 Commissioning Requirements
- B. Architect/Engineer (A/E) – The prime consultant (architect) and subconsultants who comprise the design team.
- C. Building Enclosure – The materials, components, systems, and assemblies intended to protect interior spaces from unconditioned spaces and the exterior environment, including walls, fenestration, roofing and roof openings, floors, ceilings, below-grade perimeter walls, slabs-on-grade and floor/ceiling assemblies separating interior zones with differing performance criteria.
- D. Basis of Design – A written document that details the information necessary to accomplish the Owner's Project Requirements (OPR). It records through narrative the technical concepts, performance assumptions, decisions, and product selections that fulfill the requirements of the OPR. The project-specific BOD should be periodically updated during the design and construction phases as these items are changed and refined.
- E. Building Enclosure Commissioning (BECx) – The process by which the design and constructed performance of building enclosure materials, components, assemblies, and systems are validated and documented to meet defined objectives and requirements of the project, as established by the Owner.
- F. Building Enclosure Commissioning Agent (BECA) – The Prime Contractor. For the purposes of building enclosure commissioning the Prime Contractor shall assume the role, tasks, and responsibilities of the Building Enclosure Commissioning Agent. Note that per the Owner's Building Commissioning Guidelines, the Owner does not allow the Commissioning Authority and Commissioning Agent to be the same organization or person. The Building Enclosure Commissioning Agent shall assign a representative

with expertise and authority to act on its behalf to participate in the commissioning process.

- G. Building Enclosure Commissioning Authority (BECxA) – The Owner’s representative who verifies the enclosure commissioning process is properly carried out. The BECxA leads the enclosure commissioning process, executes the detailed planning and implementation of the enclosure commissioning process, and makes final recommendations to the Owner regarding the performance of the commissioned building enclosure systems.
- H. Building Enclosure Commissioning Plan (BECx Plan) – A document prepared by the BECxA that outlines the organization, schedule, allocation of resources, responsibilities and documentation requirements of the BECx process. The plan puts a significant emphasis on defining roles and responsibilities and establishing communication protocols. The Specifications will take precedence over the BECx Plan if a conflict occurs.
- I. Building Enclosure Commissioning Report – A summary prepared at the conclusion of the project of all BECx activities that occurred, including: issue logs (including resolution and unresolved items), meeting minutes, testing results and areas where testing was performed, remediation of problems encountered during construction, the final BECx plan, the final OPR and BOD, the installer and manufacturer warranties, and the Enclosure Systems Maintenance Manual.
- J. Building Enclosure Systems Maintenance Manual – A manual which includes an overview of the enclosure systems, as-built drawings, maintenance and inspection requirements and schedule, training requirements for the building staff, and replacement schedule.
- K. Construction Checklists – Enclosure system checklists prepared by the BECxA and used by the Enclosure Installer prior to and during enclosure construction.
- L. Contract Documents – The documents binding parties involved in the construction of the project (drawings, specifications, change orders, amendments, contracts, etc.)
- M. Enclosure Installer(s) (CTR) – The company(s) engaged by the Owner or PC to provide and/or install building enclosure systems in accordance with the contract specifications, drawings, manufacturer’s recommendations and good engineering and workmanship practices.
- N. Independent Testing Agency (ITA) – The company(s) engaged by the Owner or PC to provide independent testing required for regulatory compliance and/or to verify installation or construction conforms to industry standards.
- O. Issues Log – A log maintained by the BECxA, tracking all enclosure-related issues in conflict with the BOD or Construction Documents.
- P. Ongoing Enclosure Commissioning Plan – A document developed by the BECxA, consisting of recommendations to be implemented over the service life of the structure, to re-establish enclosure-related durability, integration, and performance to a level consistent with the OPR, BOD, and Contract Documents.

- Q. Operations and Maintenance (O&M) Manual – The document that records the information pertinent to the operations and maintenance of the components, equipment, subsystems, and systems for the building enclosure. For the purpose of the enclosure commissioning, the O&M Manual is the Building Enclosure Systems Maintenance Manual.
- R. Owner's Project Requirements (OPR): A written document that details the Owner's vision and requirements of a project, and the expectations of how it will be used and operated. The OPR includes the programmatic and general performance requirements of a building, structure or portion thereof and the expectations of the Owner relative to its intended use, occupancy, operation, and service life. The project-specific OPR should be periodically updated during the design and construction phases as these requirements are changed and refined.
- S. Pre-functional Inspection – BECxA confirms the pre-construction portions of the enclosure construction checklists have been completed.
- T. Prime Contractor (PC) – An organization whose role is to manage the construction team and various installers to build and test the building systems for the project. The Prime Contractor also works with the BECxA to identify and correct any deficiencies.
- U. Project Manager (PM) – The contracting and managing authority for the Owner over the design and/or construction of the project.
- V. Seasonal Testing – Performance verification testing that is deferred until the enclosure system(s) will experience conditions closer to their design conditions.
- W. Specifications – The construction specifications of the Contract Documents.
- X. Warranty Period – Warranty period for specific enclosure components. Warranties are defined in the appropriate sections of these specifications.

1.4 COORDINATION

- A. Commissioning Team: The members of the commissioning team consist of:
 - 1. Owner
 - 2. Building Enclosure Commissioning Authority (BECxA).
 - 3. Commissioning Authority (CxA).
 - 4. Owner's Project Manager (PM) and/or designated representative of the Owner.
 - 5. Prime Contractor (PC).
 - 6. Enclosure Installer(s) (CTR).
 - 7. Independent Testing Agency (ITA)
 - 8. Architect and design engineers (A/E).
 - 9. Architect's enclosure consultant(s).
 - 10. Enclosure manufacturer representatives.
 - 11. Suppliers of materials.
 - 12. Owner's building operator/engineer.
 - 13. LEED consultant.

- B. Management: The BECxA is retained by the Owner and/or CxA. The BECxA directs and coordinates the commissioning activities and reports to the A/E, Owner and/or the PM. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.
- C. Scheduling: The BECxA will work with the PM and/or PC according to established protocols to schedule the commissioning activities. The PC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner to expedite the commissioning process.

1.5 COMMISSIONING PROCESS

- A. Building Enclosure Commissioning Process: The following narrative provides a brief overview of the typical commissioning tasks performed before, during, and after construction and the general order in which they occur:
 - 1. Refer to 019113 Commissioning Requirements
 - 2. Prior to start of construction, the BECxA prepares the outline of the Enclosure Systems Maintenance Manual (the enclosure equivalent of an O&M Manual).
 - 3. The BECxA develops the Building Enclosure Commissioning Plan. The plan details the specific enclosure commissioning tasks and processes necessary to achieve the intent of the OPR and construction documents.
 - 4. The BECxA documents the facility maintenance personnel enclosure training requirements as established by the Owner and issues the training requirements to the Prime Contractor through the outline of the Enclosure Systems Maintenance Manual.
 - 5. The BECxA issues construction checklists to the PC and Enclosure Installers.
 - 6. The BECxA Scoping Meeting is held, at least 2 months prior to the start of enclosure construction.
 - 7. The BECxA Kickoff Meeting is held, prior to the start of enclosure construction.
 - 8. As construction starts, pre-functional inspections are performed by the BECxA by confirming that the pre-construction checklist items have been completed for each enclosure system or material.
 - 9. Performance verification testing of the enclosure elements and mock-ups are performed by the Prime Contractor or Owner as work proceeds, and the BECxA observes.
 - 10. The BECxA verifies selected shop drawings and product data submittals related to the building enclosure, but they are reviewed and approved by A/E team. The submittals required for concurrent review will be those deemed important by the BECxA for inspection and testing purposes.
 - 11. The Enclosure Installer(s) complete the construction checklists under the oversight of the PC, and issues them to the BECxA regularly for review.
 - 12. Independent Testing Agency (ITA) performs tests for Building envelope systems, BECxA verifies tests at site.
 - 13. The BECxA performs enclosure construction observation at an interval established by the Owner and develops and updates an Issues Log.
 - 14. Regular enclosure commissioning meetings are held on site, where construction checklists and new issues on the Issues Log are reviewed.

15. At conclusion of construction, the BECxA compiles all enclosure commissioning documents into the Final Enclosure Commissioning Report.
16. The BECxA confirms that the training plan has been implemented.
17. The BECxA compiles the final Enclosure Systems Maintenance Manual based on information provided by the PC and A/E.
18. The BECxA, A/E, Owner, PC, and Enclosure Installer(s) participate in the 10-month post-occupancy review/walkthrough of the project to examine the condition of the enclosure systems prior to the end of the Prime Contractor's warranty period.
19. The BECxA develops the Ongoing Enclosure Commissioning Plan with recommendations as required to re-establish enclosure-related durability, integration, and performance to a level consistent with the original OPR, BOD, and Contract Documents.

1.6 RELATED WORK

- A. Specific commissioning requirements are given in the following sections of these specifications. All of the following sections apply to the Work of this section. Trade specific commissioning responsibilities and reporting requirements are provided in the following sections:
Section 019113 – General Commissioning Requirements
Section 240100 – Commissioning Requirements

1.7 RESPONSIBILITIES

- A. The responsibilities of various parties in the enclosure commissioning process are provided in this section. Further specific responsibilities, when required, for the Building Enclosure Materials Manufacturers' technical representatives and Independent Testing Laboratory are described in their particular contract specifications and documents. It is noted that the services for the Owner's Project Manager, Architect, Architect's Enclosure Subconsultants, and Enclosure Commissioning Authority are not provided for in this contract. That is, the Prime Contractor is not responsible for providing their services, and those responsibilities are listed here only for clarification of the commissioning process.
- B. All Parties
 1. Follow the Commissioning Plan.
 2. Attend the enclosure commissioning kickoff meeting and additional meetings as necessary.
- C. Architect (A/E) and/or Architect's Enclosure Subconsultants
 1. The following BECx Requirements are presented to clarify the A/E's responsibilities for BECx during the construction phase. Additional BECx tasks are performed by the A/E during the design phase.
 - a. Attend the BECx Scoping Meeting and BECx Kickoff Meeting.
 - b. Understand and follow the BECx Plan.

- c. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted. Review and incorporate BECxA review comments as needed for enclosure-related shop drawing and submittal reviews.
- d. Provide the Basis of Design documentation.
- e. Provide any design narrative documentation requested by the BECxA.
- f. Attend pre-installation meetings for each enclosure trade.
- g. Review enclosure mockups, and ensure modifications made to mockup configurations are documented.
- h. Attend reoccurring BECx meetings during the enclosure construction phase.
- i. Coordinate resolution of design non-conformance and design deficiencies identified during commissioning.
- j. Address items identified on the Issues List related to clarification of design intent.
- k. Coordinate with the BECxA in revising the OPR and BOD as necessary throughout construction.

D. Building Enclosure Commissioning Authority (BECxA)

- 1. The BECxA is not responsible for design concept, design criteria, compliance with codes, design or construction scheduling, cost estimating, or construction management. The BECxA may assist with problem solving non-conformance or deficiencies, but ultimately that responsibility resides with the PC, CTR, and A/E. The primary role of the BECxA is to develop and coordinate the execution of the BECx Plan, observe and document enclosure system performance. Specifically, that enclosure systems are provided and installed in accordance with the documented design intent and in accordance with the Contract Documents.
- 2. The following BECx Requirements are presented to clarify the BECxA's responsibilities during the construction and occupancy phases.
 - a. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner 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.
 - b. Coordinate the enclosure commissioning work and, with the PC and CTRs, verify that commissioning activities are being scheduled into the master schedule.
 - c. Develop the BECx Plan prior to start of construction.
 - d. Prepare the Enclosure Systems Maintenance Manual outline prior to start of construction.
 - e. Document the enclosure systems maintenance training requirements prior to start of construction.
 - f. Plan and conduct the BECx Scoping Meeting where long lead-time issues and BECx scope issues are addressed.
 - g. Plan and conduct the BECx Kickoff Meeting where functional performance test procedures are reviewed along with the overall BECx process.
 - h. Issue enclosure construction checklists to the PC and Enclosure Installer for each enclosure system.

- i. Perform pre-functional inspections by confirming the pre-construction portions of the enclosure construction checklists have been completed.
- j. Perform enclosure-related shop drawing and submittal reviews concurrently with the A/E. Provide comments to the A/E to implement.
- k. Issue the Owner's enclosure maintenance training requirements to the PC, to be incorporated into the Enclosure Systems Maintenance Manual.
- l. Review enclosure construction checklists periodically as they are provided by the PC and CTR.
- m. Review enclosure system mockups, and verify modifications made to mockup configurations are documented.
- n. Attend the pre-installation meeting for each building enclosure trade.
- o. Observe a representative portion of the building enclosure performance verification testing.
- p. Develop and maintain the Issues Log.
- q. Perform construction observation at frequency established by the Owner, and provide construction observation reports.
- r. Hold reoccurring BECx meetings during the enclosure construction phase.
- s. Review the Enclosure Installer's completed enclosure construction checklist for each enclosure trade.
- t. After the construction phase, complete the Enclosure Commissioning Report.
- u. Compile documents provided by the PC and A/E into the Enclosure Systems Maintenance Manual.
- v. Verify that the enclosure maintenance training plan has been implemented.
- w. Participate in the 10-month review/walkthrough of the project to examine the condition of the enclosure systems prior to the end of the Prime Contractor's warranty period.
- x. Coordinate with the electrical/mechanical CxA for seasonal performance testing.

E. Owner's Project Manager (PM)

- 1. The following BECx Requirements are presented to clarify the Owner's responsibilities during the construction and occupancy phases.
 - a. Manage the contract of the A/E, PC and BECxA.
 - b. Assist in scheduling and coordinating BECx activities.
 - c. Attend BECx meetings.
 - d. Review BECx reports and checklists.
 - e. Provide direction to address issues on the Issues Log when applicable.
 - f. Provide final approval for the completion of the enclosure commissioning work.
 - g. Address any seasonal or deferred testing and any deficiency issues.

F. Prime Contractor (PC)

- 1. The following BECx Requirements are presented to supplement the full range of responsibilities placed on the PC by the Contract Documents. The PC is responsible to ensure the Enclosure Installers and manufacturers perform their required tasks.

- a. Include the cost of supporting enclosure commissioning in the contract price.
- b. Schedule and attend the BECx scoping meeting and BECx kickoff meeting in coordination with the BECxA.
- c. Furnish a copy of all construction documents, addenda, change orders and submittals and shop drawings related to the enclosure systems to the BECxA. The BECxA will forward a request to the PC for copies of the submittals that the BECxA is required to review concurrently with the A/E as required by the LEED guidelines. The Prime Contractor bears all costs associated with providing the requested submittals to the BECxA without any additional cost to the Owner, BECxA or others.
- d. Coordinate completion of the pre-construction portions of enclosure construction checklists by the CTR prior to starting construction of a specific enclosure system.
- e. Provide coordination for performance and review of enclosure system mockups, and ensure modifications made to mockup configurations are documented.
- f. Provide coordination and access to allow the BECxA to observe enclosure construction in progress.
- g. Include the BECx program into the scheduled pre-installation meeting for each building enclosure trade.
- h. Schedule and coordinate building enclosure performance verification testing.
- i. Attend reoccurring BECx meetings during the enclosure construction phase.
- j. Review commissioning progress and deficiency reports.
- k. Coordinate the resolution of deficiencies by the CTR, identified by the BECxA in the Issues Log.
- l. Ensure that resolutions to deficiencies are documented and necessary adjustments to as-built documents are made by the CTR.
- m. During construction of each enclosure material system, ensure the CTR updates the enclosure construction checklist and return to BECxA periodically, and at completion of work.
- n. At completion of work, provide to the BECxA the information needed to complete Enclosure Systems Maintenance Manual and BECx Report, including warranties, manufacturer's product data and maintenance requirements, and any other information necessary for the operations and maintenance of the building enclosure, including clarifying and updating the original construction documents to depict as-built conditions.
- o. Coordinate and perform the training of Owner personnel. Notify the BECxA when training will take place.
- p. Participate in the 10-month review.

G. Enclosure Installers (CTR)

1. The following BECx Requirements are presented to supplement the full range of responsibilities placed on the Enclosure Installer by the Contract Documents. The Enclosure Installer is also responsible for ensuring the sub-installers and manufacturers perform their required tasks.

- a. Include the cost of supporting enclosure commissioning in the contract price.
- b. Attend the BECx scoping meeting and BECx kickoff meeting.
- c. Complete pre-construction portions of enclosure construction checklists and return to the PC and BECxA prior to starting construction of a specific enclosure system.
- d. Construct enclosure system mockups, and document modifications made to the mockup configuration for implementation on the constructed enclosure.
- e. Provide coordination and access to allow the BECxA to observe enclosure construction in progress.
- f. Include the BECx program into the scheduled pre-installation meeting for each building enclosure trade.
- g. Schedule, coordinate, and perform (as applicable) building enclosure performance verification testing.
- h. Attend reoccurring BECx meetings during the enclosure construction phase.
- i. Review commissioning progress and deficiency reports.
- j. Resolve deficiencies identified by the BECxA in the Issues Log.
- k. Document resolutions to deficiencies and make necessary adjustments to as-built documents.
- l. During construction of each enclosure material system, update the enclosure construction checklist and return to PC and BECxA periodically, and at completion of work.
- m. Coordinate and perform the training of Owner personnel.
- n. Participate in the 10-month review.

H. Independent Testing Agency (ITA)

1. Attend pre-testing meeting
2. Testing will not be scheduled until all submittals are approved. Testing shall also not be performed without written confirmation of readiness for applicable testing Independent
3. Testing Agency to perform tests for Building envelope systems, BECxA to verify tests at site.
4. ITA to provide testing procedures with equipment information, including calibration data before testing is scheduled and provide reports after testing is completed with summary including a summary of all non-compliance items.

1.8 PROBLEM SOLVING AND DOCUMENTATION

- A. The BECxA will recommend solutions if problems are found and coordinate with the DP, however the burden of responsibility to solve, correct and re-test problems is with the project team and Installers.
1. All modifications will be documented by the installer and submitted.
 2. The BECxA will document the testing to include a summary of the industry standard testing procedure, photos, the results of each test (pass/fail), photos, and retesting requirements if applicable.

1.9 SYSTEMS TO BE COMMISSIONED

- A. The following enclosure systems will be commissioned in this project. The Owner and the BECx reserves the right to amend this list at any time during the construction and acceptance process.
1. See Technical Sections for more information
 2. Visual Inspection of each Building Envelope System including but not limited to foundation, waterproofing, flashing, framing, masonry, thermal insulation, roofing, final walk through
 3. Onsite Testing on Curtain walls, Entrances and Storefronts, Windows, Glazing, Wall Panels, any other testing mentioned in technical sections, and associated transitions and accessories.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 MEETINGS

- A. BECx Scoping Meeting: A minimum of two months prior to the start of enclosure work, the BECx shall hold a BECx Scoping Meeting with the Owner, A/E, PC, and Enclosure Installers. This scoping meeting is intended to discuss the BECx processes and address long lead-time issues such as preconstruction testing, mockup and sample panel construction, and submittal reviews. Information gathered from this meeting will allow the BECx to revise the Commissioning Plan to its final version, which will also be distributed to all parties.
- B. BECx Kickoff Meeting: Prior to the start of enclosure work, the BECx shall hold a kickoff meeting with the Owner, PM, A/E, PC, Enclosure Installers, Building Enclosure Materials Manufacturers' technical representatives, and Independent Testing Laboratory. This kickoff meeting is to discuss the objectives of the BECx process, the roles and responsibilities of each team member, submittals, mock ups, construction sequencing, constructability, BECx documentation process, field observations, field performance testing activities (including repair and re-testing), project schedule, issues log, and other issues designated pertaining to project coordination, document control, and construction and validation of the building enclosure.
- C. Pre-Testing for Each Trade: During the pre-testing meeting associated with each building enclosure trade, BECx-related tasks and responsibilities shall be reviewed, including coordination of the trades, approved shop drawings, sequence of construction, the testing of components and systems, QC/QA processes, schedule, and any observed conflicts with the submittals.
- D. Reoccurring BECx Meeting: The BECx, Owner or PM, A/E, PC, and Enclosure Installers shall participate in regularly scheduled site progress meetings held every two weeks for the duration of field construction of the building enclosure. The commissioning team shall review and discuss construction observations, the issues

log, submittal review items, construction checklists, and the updated schedule for building enclosure installation, QA/QC audits, first level field testing, and field performance testing of installed systems.

3.2 REPORTING

- A. Refer to 019113 Commissioning Requirements
- B. The BECxA will provide regular reports to the Owner, CxA, PC, and A/E depending on the management structure, with increasing frequency as construction and commissioning progresses.
- C. The BECxA will regularly communicate with all members of the commissioning team, keeping them apprised for commissioning progress, and scheduling changes through memos, progress reports, etc.
- D. A final building enclosure commissioning report by the BECxA will be provided to the Owner. The report will include:
 - 1. A brief summary report that includes a list of participants and roles, brief building description, overview of enclosure commissioning and testing scope, and a general description of testing and verification methods. For each piece of commissioned system, the report should contain the disposition of the BECxA regarding the adequacy of the system, documentation, and training, in general agreement with the contract documents in the following areas:
 - a. Enclosure systems meeting the system specifications
 - b. Enclosure system installation
 - c. Functional performance
 - d. Enclosure systems documentation
 - e. Operator Training
 - 2. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to window washing equipment and operations, future actions, recommended commissioning process changes, etc. shall also be listed.
 - 3. Also included in the Final Building Enclosure Commissioning Report shall be the issue logs (including resolution and unresolved items), meeting minutes, testing results and areas where testing was performed, remediation of problems encountered during construction, the final BECx plan, the final OPR and BOD, the installer and manufacturer warranties, and the Enclosure Systems Maintenance Manual.
- E. The BECxA will compile an enclosure systems maintenance manual that will consists of the following:
 - 1. Overview of the enclosure systems
 - 2. As-built drawings
 - 3. Maintenance and inspection requirements and schedule
 - 4. Training requirements for the building staff
 - 5. Replacement schedule

3.3 SUBMITTALS

- A. The BECxA will provide the PC with a specific request for the type of submittal documentation the BECxA requires to facilitate the enclosure commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. All documentation requested by the BECxA will be included by the CTRs in their O&M manual contributions.
- B. The BECxA will review submittals related to the commissioned systems for conformance to the OPR and BOD, to Contract Documents, to the functional performance of the systems, and to the adequacy for developing test procedures. The BECxA will notify the Owner, CxA, PC or A/E as requested, of items not included or areas that are not in conformance with Contract Documents and which require resubmission. The BECxA does not have approval responsibility, but is required to review the submittals concurrently with the design team as it may be required by LEED guidelines.
- C. The BECxA may request additional design narrative from the A/E and Enclosure Installer(s), depending on the completeness of the design intent documentation and sequences provided with the Specifications.
- D. The BECxA shall review the submittals once. The BECxA shall receive a copy of the final approved submittals.

3.4 Construction Checklists:

- A. Construction checklists are prepared by the BECxA and used by the Enclosure Installer to verify that the building enclosure components are installed in compliance with the project specifications, the manufacturer's installation instructions, and industry best practices.
- B. Each of the building enclosure systems require a separate checklist for installation. These checklists are to be reviewed by the Owner or PM, A/E, PC, and Enclosure Installer, with input from the enclosure product manufacturer, facility manager, and O&M staff (as applicable). The checklists should be reviewed and finalized at the pre-installation meeting for each building enclosure trade/component and submitted by the Prime Contractor at regular intervals throughout installation of the enclosure trade/component.
- C. Checklists shall have a preliminary section for pre-construction verification of items, such as submittals (product data, shop drawings, compatibility certificates, qualification data, etc.), as well as confirming the pre-installation conference, examination of unique conditions and material interfaces, any required pre-construction field testing, and scheduling of inspectors.
- D. The installation portion of the checklist shall cover items such as storage, surface preparation, installation procedures, cleaning, protection, testing, and warranty inspections.

3.5 Documentation, Non-Conformance and Approval of Tests

A. Issues Log:

1. Issues logs are generated to document deviations from the contract documents, conflicts in the submittals, and performance issues in conflict with the OPR. The issues log is to be prepared by the BECxA and reviewed by the PM or Owner. The log will be introduced to the construction team at the pre-construction BECx kickoff meeting and used by the A/E, PC, Enclosure Installers, and enclosure testing companies. The issues log should be reviewed and updated at progress meetings (preferably weekly), BECx team meetings, and during BECxA site visits.
2. The BECxA does not approve or reject work by the Prime Contractor. The issues generated by the BECxA in the Issues Log are presented for consideration by the Commissioning Team.
3. Issues can be removed from the active Issues Log by the BECxA by the following methods, as applicable:
 - a. The Prime Contractor or Enclosure Installer corrects the non-compliance.
 - b. The Prime Contractor or Enclosure Installer provides additional documentation indicating compliance with construction documents.
 - c. The A/E provides design clarification.
 - d. The A/E accepts the discrepancy or potential issue.
 - e. The PM or Owner accepts the discrepancy or potential issue.
 - f. Other methods of resolution proposed by the Commissioning Team.
4. The Prime Contractor shall respond in writing to the BECxA at least as often as enclosure commissioning meetings are scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
5. The issues log shall include:
 - a. Unique numbering system for each issue
 - b. Detailed description
 - c. The initial observer
 - d. Date
 - e. Enclosure system impacted
 - f. Location of issue
 - g. Responsible party
 - h. Reference to the applicable Contract Documents
 - i. Resolution description, status, and date, including any testing performed to verify resolution
 - j. If any Owner-accepted deviations are made to the CDs or BOD to resolve an issue, these should be documented formally.

B. For enclosure testing, as testing progresses and a deficiency is identified, the BECxA will discuss the issue with the Contractor and Testing Agency for follow-up and resolution.

1. Installer's response in writing as to the cause of the failure and proposed resolution.
2. The applicable subcontractor corrects the deficiency, responds to the deficiency in the Commissioning Issues Log certifying that the issue is resolved and /or the

- product, material or assembly is ready to be retested and notifies the Project Team
 - 3. The Owner will determine whether a replacement of all identical units is required or if a repair is acceptable.
 - 4. Upon acceptance, the responsible party shall replace or repair all identical items at their expense and shall extend the warranty accordingly.
 - 5. Systemic or frequent failures may result in additional testing beyond originally identified to verify performance.
 - 6. Based on the type of failure and the rate of frequency, the number of additional tests will be negotiated between the BECxA, the Owner, and the testing agency
 - 7. Final acceptance authority is with the Owner and Design Professional.
- C. Documentation – The BECxA shall witness and document the results of a portion of the field performance verification testing, as defined in the BECx Plan. The BECxA does not approve or reject the systems verified based on the observed testing, but will advise the PM/Owner and A/E.

3.6 PERFORMANCE VERIFICATION TESTING

- A. Quality Assurance and Control: enclosure-related performance verification testing, quality-assurance, and quality-control requirements for individual building envelope systems and materials, methods, and assemblies are specified in the technical specification sections relating to those activities. Additional specified BECx tests, inspections, and related actions are specified in this section, but do not limit Prime Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
- B. Costs associated with re-testing caused by failure of the performance verification testing, during mock-up or construction phase work, shall be the responsibility of the Prime Contractor.

3.7 TRAINING OF OWNER PERSONNEL

- A. The PC shall be responsible for training coordination and scheduling and for ultimately ensuring that training is completed. The PC shall inform the BECxA when training will be scheduled.
- B. The BECxA shall be responsible for overseeing and approving the content and adequacy of the training of the Owner personnel.
- C. The BECxA shall interview the facility manager and lead engineer to determine the special needs and areas where training would be most valuable. The Owner and CxA shall decide how rigorous the training should be for each piece of commissioned enclosure system.
- D. In addition to these general requirements, the specific training requirements of Owner's personnel by CTRs, as detailed in the specifications, shall be provided.

- E. Each CTR and vendor responsible for training will submit a written training plan to the BECxA, for review and approval prior to training. The plan will cover the following elements:
1. Equipment or system (included in training)
 2. Intended audience
 3. Location of training
 4. Objectives
 5. Subjects covered (description, duration of discussion, special methods, etc.)
 6. Duration of training on each subject
 7. Instructor for each subject and qualifications
 8. Methods (classroom lecture, video, site walk thru, actual demonstrations, etc.)
- F. The BECxA develops criteria for determining that the training was satisfactorily completed, including attending some of the training.

3.8 WRITTEN WORK PRODUCTS

- A. The BECx process generates a number of written work products described in various parts of the specifications. The BECx Plan lists all the formal written work products, describes briefly their contents, who is responsible to create them, and who receives and approves them. In summary the written products are:

<u>Product</u>	<u>Developed By</u>
1. Owner's Project Requirements (OPR) for the Enclosure	Owner and BECxA
2. Basis of Design (BOD) for the Enclosure	A/E and BECxA
3. Building Enclosure Commissioning Plan	BECxA
4. Enclosure Material Submittals	CTR
5. Shop Drawing Submittals with A/E and BECxA Comments	CTR
6. Enclosure Warranties	CTR
7. Checklists (Pre-Functional Inspection and Construction Checklists)	Generated by BECxA and implemented by PC and CTR
8. BECx Construction Observation Reports	BECxA
9. Building Enclosure Systems Maintenance Manual (O&M Manual)	BECxA, based on information provided by PC and A/E
10. Performance Verification Testing Reports	ITA, CTR

11.Issues Log	BECxA
12.Final Building Enclosure Commissioning Report	BECxA
13.Ongoing Enclosure Commissioning Plan	BECxA

END OF SECTION 01 9107

SECTION 01 9113 - COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. General requirements for coordinating and scheduling commissioning.
2. Commissioning meetings.
3. Commissioning reports.
4. Use of test equipment, instrumentation, and tools for commissioning.
5. Construction checklists review, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
6. Commissioning tests and commissioning test demonstration.
7. Adjusting, verifying, and documenting identified systems and assemblies.

1.2 DESCRIPTION

- A. Commissioning:** Commissioning is a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meet defined objectives and criteria. The Commissioning process begins at project inception (during the pre-design phase) and continues through the life of the facility. The commissioning process includes specific tasks to be conducted during each phase in order to verify that design, construction, and training meets the owner's project requirements.
- B. Commissioning Team:** The members of the commissioning team consist of the contracted commissioning authority (CA), the owner's representative/construction manager (CM), the general contractor (GC), the architect and design engineers (AE), the mechanical contractor (MC), the electrical contractor (EC), the testing and balancing (TAB) contractor, the control contractor (CC), the facility operating staff, and any other installing subcontractors or suppliers of equipment. The contracted commissioning authority is hired directly by the owner. The CA directs and coordinates the project commissioning activities and the reports to the owner. All team members work together to fulfill their contracted responsibilities and meet the objectives of the contract documents. Commissioning shall :
1. Verify that applicable equipment and systems are installed according to the contract documents, manufacturer's recommendations, and 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 is complete.
 4. Provide future operating staff the information needed to understand and optimally operate the commissioned systems.

- C. 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.
- D. Commissioning protocols will be those necessary to meet the requirements of SUCF 1B-6 on Commissioning requirements, NYS Codes, similar to LEED BD+C- v4 Fundamental Commissioning and Energy and Atmosphere Credit 3 – Enhanced Commissioning with envelope commissioning.

1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division 1 specification sections, apply to this section.
- B. Owner's Project Requirements and Basis of Design documents are included by reference for information only.
- C. ASHRAE Guideline 0-2005

1.4 DEFINITIONS

- A. Acceptance - A formal action, taken by a person with appropriate provider to declare that some aspect of the project meets defined requirements, thus permitting subsequent activities to proceed.
- B. Approval - Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the contract documents.
- C. Basis of Design - A document that records the concepts, calculations, decisions, and product selections used to meet the owner's project requirements 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.
- D. Checklists - Verification checklists that are developed by Commissioning Authority and used during all phases of the commissioning process to verify that the owner's project requirements are being achieved. This includes checklists for general verification, plus testing, training, and other specific requirements.
- E. Commissioning Authority (CA) - The entity identified by the owner who leads, plans, schedules, and coordinates the commissioning team to implement the commissioning process.
- F. Commissioning Plan - An overall plan developed by the commissioning authority that provides the structure, schedule and coordination planning for the commissioning process.
- G. Commissioning Process - A quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner's project requirements.

- H. Commissioning Process Progress Report - A written document that details activities completed as part of the commissioning process and significant findings from those activities that is continuously updated during the course of a project. Usually it is incorporated into the commissioning plan as an ongoing appendix.
- I. Commissioning Team - The individuals who through coordinated actions are responsible for implementing the commissioning process.
- J. Coordination Drawings - Drawings showing the work of all trades to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances.
- K. Control system - A component of environmental, HVAC, security, and fire systems for reporting/monitoring and issuing of commands to/from field devices.
- L. Data logging -The monitoring and recording of flows, currents, status, pressures, etc., of equipment using stand-alone data recorders separate from the control system or the trending capabilities of control systems.
- M. 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.
- N. Factory Testing - Testing of equipment on-site or at the factory, by factory personnel, with or without an owner's representative present.
- O. Issues Log - A formal and ongoing record of problems or concerns – and their resolution – that have been raised by members of the commissioning team during the course of the commissioning process.
- P. Owner's Project Requirements - A written document that details the functional requirements of a project and the expectations of how it will be used and operated. This includes project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. (The term "Project Intent" is used by some owners for their commissioning process owner's project requirements or design.)
- Q. Quality Based Sampling - A process for evaluating a sub-set (sample) of the total population. The sample is based upon a known or estimated probability distribution of expected values; an assumed statistical distribution based upon data from a similar product, assembly, or system; or a random sampling that has scientific statistical basis.
- R. Seasonal Performance Tests - Performance tests that are deferred until the system(s) will experience conditions closer to their design conditions based on weather conditions.
- S. Simulated Condition - Condition that is created for the purpose of testing the response of a system (e.g., raising/lowering the setpoint of a thermostat to see the response in a VAV box).

- T. Simulated Signal - Disconnecting a sensor and using a signal generator to simulate a sensor value for the purpose of testing a full range of conditions.
- U. Startup - The initial starting or activating of dynamic equipment, including completing construction checklists.
- V. Systems Manual - A system-focused composite document that includes the operation manual, maintenance manual, and additional information of use to the owner during the occupancy and operations phase.
- W. Test Procedure - A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems. The test procedures are specified in the Technical Specifications sections of the contract documents. Performance testing covers the dynamic functions and operations of equipment and systems using manual or monitoring methods. Performance testing is the dynamic testing of systems under full operation. Systems are tested under various modes, such as during low cooling 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 respond as the sequences state.
- X. Training Plan - A written document that details the expectations, schedule, and deliverables of commissioning process activities related to training of project operating and maintenance personnel, users, and occupants.
- Y. Verification - The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project Requirements.

1.5 COORDINATION

- A. Project Commissioning Team - The members of the project commissioning team will consist of the commissioning authority, the construction manager, the owner's facility staff (FS), the general contractor, subcontractors and/or vendors as required, and the architect/ engineer (A/E).
- B. Management - The CA coordinates the commissioning activities through the construction manager. All members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- C. Scheduling - The CA, through the CM, will provide sufficient notice to the contractor for scheduling commissioning activities. The contractor will integrate all commissioning activities into the overall project schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

1.6 COMMISSIONING PLAN

- A. The CA will develop the commissioning plan which shall be included in the project schedule when approved by the owner or CM. 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 CA where the commissioning process is reviewed with the project commissioning team members.
 2. Additional meetings will be required throughout construction, scheduled by the CA, through the CM, with necessary parties attending to plan, scope, coordinate, schedule future activities and resolve problems.
 3. Equipment documentation is submitted to the CA, through the owner or CM, during normal submittals, including detailed startup procedures.
 4. The construction checklists are to be executed by the contractor (or its subcontractors) and documented by commissioning authority.
 5. Pre-functional checklists, TAB and startup must be completed before performance testing.
 6. Items of non-compliance in material, installation, or setup shall be corrected at no expense to the owner.
 7. The contractor ensures that the subcontractors' construction checklists are executed and documented and that startup and initial checkout are performed. The CA verifies that the TAB, construction checklists and startup were completed according to the approved plans. This includes the CA approving TAB, checklists and startup plans. 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.
 8. The CA develops and implements equipment and system performance test procedures.
 9. The performance tests are executed by the contractor under the direction of the CA with the assistance of the facility staff. All documentation is by the CA.
 10. The CA reviews the O&M documentation for completeness and provides the commissioning record for the O&M manuals.
 11. Commissioning should be completed before substantial completion.
 12. The CA develops procedures, reviews, pre-approves, coordinates, and implements the training provided by the contractor and equipment vendor.
 13. Seasonal testing is conducted as specified or required.

1.7 COMMISSIONING TEAM

- A. The commissioning team will be comprised of representatives from each discipline involved in the commissioning process. The core members of the team will be required to attend all meetings. The core team members include the following:
1. Owner
 2. Facility Operator (end user)
 3. Architect
 4. Engineers
 5. CA

6. Construction Manager
7. General Contractor
8. Mechanical Contractor
9. Electrical Contractor
10. Control Contractor
11. TAB Agency

B. Team Members Appointed by Owner:

1. CA: An entity identified by the Owner that leads, plans, schedules, and coordinates the commissioning team to implement the commissioning process. The Owner will engage the CA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

C. Team Members Appointed by Contractor(s):

1. Representatives of each contractor, including project superintendent and subcontractors, installers, vendor, suppliers, and specialists deemed appropriate by the CA. The individuals shall each have authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions.

D. The commissioning team will meet on a regular basis as defined by the CA in the "kick-off" meeting. The frequency of the meetings will be determined by the activity of the construction and the nearness to completion of each specialty.

E. Non-core team members will be required to attend meetings as scheduled by the team in order to provide seamless continuity to the commissioning progress schedule.

1.8 RESPONSIBILITIES

A. The general responsibilities of various parties in the commissioning process are provided in this sub-section. The specific responsibilities are in the Technical Specifications.

B. All Parties:

1. Follow the commissioning plan.
2. Attend initial commissioning meeting and additional meetings as necessary.

C. Architect

Construction Phase

1. Attend the commissioning scoping 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 documentation requested by the CA.

4. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
5. Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.

D. Mechanical and Electrical Designers/Engineers

Construction Phase

1. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. One site observation should be completed just prior to system startup.
2. Provide any design narrative and sequences documentation requested by the CA. 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.
3. Attend commissioning scoping meetings and other selected commissioning team meetings.
4. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
5. Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.

Occupancy and Operations Phase

1. Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.
2. Attend lessons learned session

E. Commissioning Authority (CA)

The CA will verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 10 to 100 percent. Verification will include, but is not limited to equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, CA will report the failure in the "Issues Log."

Construction Phase

1. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner 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 owner/CM, help integrate commissioning activities into the master schedule.
3. Revise the Construction Phase Commissioning Plan as necessary.

4. Plan and conduct a commissioning scoping meeting and other commissioning meetings.
5. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor startup and checkout procedures.
6. Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
7. Review and approve normal contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
8. Write and distribute construction checklists. Prepare and maintain completed construction checklist log.
9. Develop an enhanced startup and initial systems checkout plan with subcontractors.
10. Perform site visits, as necessary, to observe component and system installations. Attend 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.
11. Witness all or part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owner/CM of any deficiencies in results or procedures.
12. Witness all or part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.
13. Approve construction checklist completion by selected site observation and spot checking.
14. Recommend approval of systems startup by reviewing startup reports and by selected site observation.
15. Review TAB execution plan.
16. Oversee sufficient testing of the control system and approve it to be used for TAB, before TAB is executed.
17. Recommend approval of air and water systems balancing by spot testing, by reviewing completed reports and by selected site observation.
18. With necessary assistance and review from installing contractors, write the performance test procedures for equipment and systems, including energy management control system trending or manual performance testing.
19. Analyze any performance trend logs and monitoring data to verify performance.
20. Coordinate, witness, and recommend approval of manual performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
21. Maintain a master Issues Log and a separate testing record. Provide the owner/CM with written progress reports and test results with recommended actions.
22. Review equipment warranties to ensure that the owner's responsibilities are clearly defined.
23. Oversee and approve the training of the owner's operating personnel.
24. Compile and maintain a commissioning record and re-commissioning manual.

25. Review and approve the preparation of the O&M manuals.
26. Provide a final commissioning report

Occupancy and Operations Phase

1. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
2. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.
3. Assist in the development of a preventative maintenance plan, a detailed operating plan or an energy and resource management plan or as-built documentation.

F. Owner or Owner's Representative (CM)

Construction and Acceptance Phase

1. Facilitate the coordination of the commissioning work by the CA, and, with the GC and CA, ensure that commissioning activities are being scheduled into the master schedule.
2. Attend a commissioning scoping meeting and other commissioning team meetings.
3. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.
4. When necessary, observe and witness startup and performance testing of selected equipment.
5. Review commissioning progress and deficiency reports.
6. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
7. Assist the GC in coordinating the training of owner personnel.
8. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

Occupancy and Operations Phase

1. Assist the CA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.
2. Attend lessons learned session

G. Owner's Project Manager (PM)

Construction Phase

1. Manage the contract of the A/E and of the GC.
2. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions.
3. Provide final approval for the completion of the commissioning work.
4. Occupancy and Operations Phase
5. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.
6. Attend lessons learned session

H. Contractor

The Contractor / Supplier shall be responsible for labor, necessary instruments, and management associated with the performance of commissioning tasks. The Commissioning agent shall witness all tasks. Contractor and their subcontractors and vendors shall assign representatives with expertise and authority to act on their behalf and schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

Construction Phase

1. Facilitate the coordination of the commissioning and incorporate commissioning activities (the Commissioning Plan) into the Overall Project Schedule (OPS).
2. Provide detailed startup procedures
3. Include the cost of commissioning in the total contract price.
4. Ensure that all subcontractors and vendors execute their commissioning responsibilities according to the contract documents and the OPS.
5. Attend and participate in commissioning team meetings.
6. No later than 30 days prior to startup of the first piece of major equipment, meet with the CA, CM to finalize the detailed commissioning procedures/ schedule.
7. Provide the training of owner personnel.
8. Review and accept construction checklists provided by the commissioning authority.
9. Accomplish commissioning process test procedures.
10. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
11. Cooperate with the CA for resolution of issues recorded in the "Issues Log".
12. Prepare O&M manuals, according to the contract documents, including clarifying and updating the original sequences of operation to as-built/as-tested conditions.

Occupancy and Operations Phase

1. Ensure that subcontractors provide assistance for seasonal or deferred performance testing, performed by the CA, according to the specifications.
2. Ensure that subcontractors correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.
3. Perform all guarantee work for materials furnished under the contract for the time specified in the contract, including all warranties and curing all latent defects within the time period provided in the contract.

I. Vendors/Subcontractors

1. Provide all requested submittal data, including detailed startup procedures and specific responsibilities of the owner to keep warranties in force.
2. Assist in equipment testing per agreements with subcontractors and/or contractor.
3. Include cost of all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing, operating, and maintaining

equipment according to these contract documents in the base bid price to the contractor.

4. Provide requested information regarding equipment sequence of operation and testing procedures.
5. Review construction checklists and test procedures for equipment installed by factory representatives.

1.9 EQUIPMENT/SYSTEMS TO BE COMMISSIONED

A. The following systems and assemblies will be commissioned:

1. Mechanical, including and not limited to all HVAC&R equipment and controls, pumps, fans, ductwork, piping
2. Plumbing, including and not limited to piping, domestic hot water systems, pumps and controls
3. Electrical, including service, distribution, lighting, and controls, including daylighting controls
4. Energy and performance measurement and monitoring systems and equipment
5. Building envelope, including and not limited to all thermal components, roofing, windows, doors, curtainwalls, insulation, exterior wall system.

1.10 SUBMITTALS

A. Comply with requirements of this document (General Commissioning Requirements).

B. Commissioning Plan Information:

1. List of commissioning team members to include specific personnel and subcontractors to the performance of the various commissioning requirements.
2. Schedule of commissioning activities, integrated with the construction schedule.
3. Contractor personnel and subcontractors to participate in each test.
4. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.

C. Commissioning schedule and Two-week look-ahead schedules.

D. List test instrumentation, equipment, and monitoring devices. Including but not limited to Make, model, serial number, and application for each instrument, equipment, and monitoring device; brief description of intended use, Calibration record with Calibration agency information, range of values, last date of calibration, certification of accuracy, due date of next calibration.

E. Commissioning Issues Reports: Daily, at the end of each day in which tests are conducted, submit commissioning issue reports for tests for which acceptable results were not achieved.

F. Commissioning Report: At construction phase commissioning completion, include the following-

1. Pre-startup reports.

2. Approved test procedures
 3. Test data forms, completed and signed.
 4. Progress reports.
 5. Commissioning issues report log.
 6. Commissioning issues reports showing resolution of issues.
 7. Correspondence or other documents related to resolution of issues.
 8. Other reports required by commissioning.
 9. List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction Phase Commissioning Completion.
 10. Report shall include commissioning work of Contractor.
- G. The CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires facilitating the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed startup procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the commissioning authority. All documentation requested by the CA will be included by the subcontractors in their O&M manual contributions.
- H. The CA may request additional design narrative from the A/E and controls contractor, depending on the completeness of the OPR documentation and sequences provided with the specifications:

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. All standard testing equipment required to perform startup and initial checkout and required performance testing shall be provided by the contractor for the equipment being tested.
- B. Proprietary test equipment and software required by any equipment manufacturer for programming and / or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. The manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance within 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 to NIST traceable standards within the past year to an accuracy of 0.5 degree F and a resolution of + or - 0.1 degree 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

- D. Installing Contractor shall be responsible for all equipment and accessories that they may require to perform their tasks such as radios for communications, hot spot (or similar devices) for internet access, etc

2.2 REPORT FORMAT

- A. General: All reports shall be submitted in electronic format, preferably in pdf. All sections, folders and subfolders in the report shall be properly labeled
- B. For each test, include:
 - 1. Test specification and Description.
 - 2. Pre-startup reports.
 - 3. Approved test procedures.
 - 4. Test data forms, completed and signed.
- C. Provide Summary including a summary of all non-compliance items.

PART 3 - EXECUTION

3.1 MEETINGS

- A. Initial Meeting. The CA, through the owner/CM, will schedule, plan and conduct an initial commissioning meeting. The contractor and its responsible parties are required to attend.
- B. Miscellaneous Meetings. Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution, and planning issues. These meetings will be held at least monthly, until the final 3 months of construction, when they may be held as frequently as one per week.

3.2 STARTUP, CONSTRUCTION CHECKLISTS, AND INITIAL CHECKOUT

- A. The following procedures apply to all equipment/systems to be commissioned, according to Paragraph 1.8 Equipment / Systems to be Commissioned.
- B. General. Construction checklists are important to verify that the equipment and systems are fully connected and operational. It ensures that performance testing (in-depth system checkout) may proceed without unnecessary delays. The construction checklists for a given system must be successfully completed and approved prior to startup and formal performance testing of equipment or subsystems of the given system.
- C. Startup and Checkout Plan. The CA will assist the project commissioning team members responsible for startup of any equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures has been completed. The CA shall provide construction checklists and startup shall be identified in the commissioning scoping meeting and on the checklist forms

1. The construction checklists are developed and provided by CA. These checklists indicate required procedures to be executed as part of startup and initial checkout of the systems.
 2. The contractor shall determine which trade is responsible for executing each of the line item tasks and transmit the checklists to the responsible subcontractors. Each form may have more than one trade responsible for its execution.
 3. The CA shall develop the full startup plan by combining the manufacturer's detailed startup and checkout procedures and the construction checklists.
 4. The contractor will transmit the full startup plan to the subcontractors for their review and use.
- D. Sensor and Actuator Calibration. All field-installed temperature, relative humidity, CO, CO₂, refrigerant, O₂, and/or pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated. Verify that all locations are appropriate and away from causes of erratic operation. Submit to the CA through the CM the calibration methods and results. All test instruments shall have had a certified calibration within the last 6 months to NIST traceable standards, and comply with all local, state and/or federal requirements/certifications, as required. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
- E. Sensor Calibration Methods
1. 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.
 2. 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.
 3. 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.

Tolerances, Standard Applications

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

- F. Valve and Damper Stroke Setup and Check EMS Readout-- For all valve and damper actuator positions checked, verify the actual position against the BAS readout. 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).
- G. 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.
- H. 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.
- I. Execution of Construction Checklists and Startup.
- Four weeks prior to the scheduled startup, the contractor shall coordinate startup and checkout with the CM, A/E, and CA. The execution and approval of the

construction checklists, startup, and checkout shall be directed and performed by the contractor, subcontractor or vendor. Signatures are required of the applicable subcontractors for verification of completion of their work.

2. The owner/CM, and A/E as necessary, shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, in which case a sampling strategy may be used. The CA will observe all testing.
3. For lower-level components of equipment, (e.g., sensors, controllers), the CA shall observe a sampling of the startup procedures.
4. The subcontractors and vendors shall execute startup and provide the CA and A/E, through the owner/CM, with a signed and dated copy of the completed startup and construction checklists.
5. Only individuals of the contractor (technicians, engineers, tradesmen, vendors, etc.) who have direct knowledge and witnessed that a line item task on the construction checklist was actually performed shall check off that item. It is not acceptable for witnessing supervisors to fill out these forms.

J. Deficiencies, Non-Conformance, and Approval in Checklists and Startup (Master Issues Log).

1. The CA will clearly list any outstanding items of the initial startup and construction checklist procedures that were not completed successfully.
2. The installing subcontractors or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, shall notify the owner/CM as soon as outstanding items have been corrected, and resubmit an updated startup report with a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CA will recommend approval of the execution of the checklists and startup of each system.
3. Items left incomplete, which later cause deficiencies or delays during performance may result in back charges to the contractor. Refer to Paragraph 3.5, herein, for details

3.3 PERFORMANCE TESTING

- A. Requirements. The performance testing shall demonstrate that each system is operating according to the documented design intent and contract documents. Performance testing facilitates bringing the systems from a state of individual 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.
- B. 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 performance testing to be scheduled. The commissioning team shall oversee, witness, and document the performance all equipment and systems. The CA in association with the contractor/subcontractors and facility staff shall execute the tests. Performance testing shall be conducted after the construction checklists, and startup has been satisfactorily completed. The control system shall be sufficiently tested and approved by the CA before it is used, to verify performance of other components or systems. The air balancing and water balancing shall be completed before performance 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 or coordinated responses between systems shall be checked.

- C. Development of Test Procedures. Before test procedures are finalized, the contractor shall provide to the CA all requested documentation and a current list of changes affecting equipment or systems, including an updated points list, program code, control sequences, and testing parameters. Using the testing parameters and requirements in the technical specifications, the CA shall update/develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each contractor/subcontractor or vendor, as appropriate, shall provide assistance to the CA in developing the final procedures.
- D. Test Methods.
 - 1. Performance testing and verification may be achieved by manual testing or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data loggers. The CA may substitute specified methods or require an additional method to be executed other than what was specified. CA will determine which method is most appropriate for tests that do not have a specified method.
 - 2. Simulated Conditions. Simulating conditions shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
 - 3. Overridden Values. Overriding sensor values to simulate a condition, such as overriding the outside air temperature reading in a control system to be something other than it really is, is acceptable.
 - 4. Simulated Signals. 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 overridden values.
 - 5. Altering Setpoints. Rather than overriding sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable.
 - 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 test parameters, that the indirect readings through the control system represent actual conditions and responses.
 - 7. Setup. Each performance test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The contractor/subcontractor(s) assisting the CA in 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 contractor/subcontractor(s) shall return all affected equipment and systems to their approved operating settings.
- E. Test Equipment. Refer to Part 2 for test equipment requirements.
- F. Problem Solving. The burden of responsibility to solve, correct, and retest malfunctions/failures is with the contractor, with A/E approval as required.

3.4 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS

- A. Documentation. The CA shall witness and complete all documentation for performance testing.
- B. Non-Conformance.
 - 1. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form or on an attached sheet.
 - 2. As tests progress and a deficiency is identified, the CA shall discuss the issue with the commissioning team, and the contractor.
 - a. When there is no dispute on the deficiency and the contractor accepts responsibility to correct it:
 - 1) The CA will document the deficiency and the contractor's response and intentions. After the day's work, the CA will submit the non-compliance reports to the CM. The contractor corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be re-tested and sends it back to the CA.
 - 2) The contractor shall reschedule the test; and the test repeated.
 - b. If there is a dispute about a deficiency, regarding whether or not it is a deficiency:
 - 1) The dispute shall be documented on the non-compliance form with the contractor's response.
 - 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 construction manager.
 - 3) The CA documents the resolution process.
 - 4) Once the interpretation and resolution have been decided, the contractor corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA, through the CM. The contractor shall reschedule the test and the test repeated until satisfactory performance is achieved.
 - 3. Cost of retesting a performance test is the contractor's responsibility.
 - 4. The contractor shall submit in writing to the CM at least as often as commissioning meetings are being scheduled, the status of each outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreement and proposals for their resolutions.
 - a. The CA retains the original non-conformance forms until the end of the project.
 - b. Retesting shall not be considered a justified reason for a claim of delay or for a time extension by the contractor.
- C. Failure Due to Manufacturer Defect. If 10% (or three, whichever is greater) of identical pieces of equipment fail to perform to the contract documents (mechanically or substantively) due to a manufacturing defect, not allowing it to meet its submitted performance specification, all identical units may be considered unacceptable by the A/E or CA. In such case, the contractor shall provide the owner with the following:

1. Within one week of notification from the owner/CM, 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 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. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
 3. The A/E will determine whether a replacement of all identical units or a repair is acceptable.
 4. Two examples, where applicable, of the proposed solution shall be installed by the contractor and the A/E shall be allowed to test the installations for up to one week, upon which the A/E 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. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- D. Approval. The CA notes each satisfactorily demonstrated function on the test form. Final approval of the performance test is made by the owner after review by the CA and CM, following recommendations by the A/E.

3.5 DEFERRED TESTING

- A. Unforeseen Deferred Tests. If any check or test cannot be completed due to the project completion level, required occupancy condition or other deficiency, execution of checklists and performance testing may be delayed upon approval of the CA and CM. 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 CA shall coordinate this activity through the owner/CM. Tests will be executed, documented by the CA and deficiencies should be corrected by the appropriate contractor/ subcontractors with the CA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing shall be made by the contractor.

3.6 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 CA.
- 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 CA through the CM, a training plan thirty 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 for 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 are required. More than one party may be required to execute the training.
 - 6. The controls contractor shall attend sessions other than the controls training, as specified, 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 the printed installation, operation and maintenance instruction material included in the O&M manuals.
 - b. 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.
 - c. Discussion of relevant health and safety issues and concerns.
 - d. Discussion of warranties and guarantees.
 - e. Common troubleshooting problems and solutions.
 - f. Explanatory information included in the O&M manuals.
 - g. Discussion of any peculiarities of equipment installation or operation.
 - h. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
 - i. 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.
 - j. 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 CA, training may occur before performance testing is complete if required by the facility operators to assist the CA in the performance testing.
- D. The CA at the beginning of each training session presents the overall system narrative and the design concept of each equipment section.

3.7 OPERATIONS AND MAINTENANCE MANUALS/DATA

- A. The commissioning process requires detailed O&M documentation as identified in this section and technical specifications.
- B. Contractor shall submit two draft copies of the complete operating and maintenance manual to the CM for review by the architect/engineer and CA within 60 calendar days after review of equipment shop drawings.
- C. Contractor shall submit corrected final approved manuals prior to substantial completion. Prior to final submittal, the CA 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 CA 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 CA will recommend approval and acceptance of these sections of the O&M manuals to the CM. The CA 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.
- D. The contractor shall compile O&M manuals for every piece of equipment and building operating or electrical system being commissioned with the following format:
 - 1. Format: 8 1/2 x 11 3 ring loose-leaf binders, 3-inch maximum, and electronic format that is compatible with owner's system. Each binder shall be clearly labeled on the spine. Use as many binders as required. Do not overload binders. Dividers with permanently marked tabs of card stock shall separate each section and sub section. Tab labels shall not be handwritten. A separate manual or chapter shall be provided for each applicable system listed in Section 1.8: Equipment and Systems to be Commissioned.
 - 2. There shall be a title page and table of contents in the front of each binder for each binder's contents. In each binder, there shall be a main tab for each specification section. Behind the section number tab there shall be the equipment ID tag sub-tab for each piece of major equipment (or group, if small or numerous). These sub-tabs shall be similar to the specification number tabs but of a different color. Behind each equipment name tab shall be the following sections, in the given order, divided by a double weight colored sheet labeled with the title of the section.
 - a. Contractor. The first page behind the equipment tab shall contain the name, address and telephone number of the manufacturer and installing contractor and the 24-hour number for emergency service for all equipment in this section, identified by equipment.
 - b. Submittal and Product Data. This section shall include all approved submittal data, cut sheets, data base sheets and appropriate shop

drawings. If submittal was not required for approval, descriptive product data shall be included.

- c. Operation and Maintenance Instructions. These shall be the written manufacturer's data with the model and features of this installation clearly marked and edited to omit reference to products or data not applicable to this installation. This section shall include data on the following:
- 1) Model number, serial number and nameplate data for each piece of equipment and any subcomponent.
 - 2) Installation, startup and break-in instructions.
 - 3) All starting, normal shutdown, emergency shutdown, manual operation and normal and emergency operating procedures and data, including any special limitations.
 - a) Step-by-step procedure for system startup, including a pre-start checklist. Refer to controls and indicators by nomenclature consistent with that used on panels and in control diagrams.
 - b) Sequence of operation, with detailed instruction in proper sequence, for each mode of operation (i.e., day-night; staging of equipment).
 - c) Emergency operation: If some functions of the equipment can be operated while other functions are disabled, give instructions for operations under these conditions. Include here only those alternate methods of operations (from normal) which the operator can follow when there is a partial failure or malfunctioning of components, or other unusual condition.
 - d) Shutdown procedure: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instructions in that order.
 - 4) O&M and installation instructions that were shipped with the unit.
 - 5) Preventative and corrective maintenance, with service procedures and schedules:
 - a) Provide a schedule for preventive maintenance in a printed format and an electronic format compatible with owner's system. State, preferably in tabular form, the recommended frequency of performance for each preventive maintenance task, cleaning, inspection and scheduled overhauls.
 - b) Cleaning: Provide instructions and schedules for all routine cleaning and inspection with recommended lubricants.
 - c) Inspection: If periodic inspection of equipment is required for operation, cleaning or other reasons, indicate the items to be inspected and give the inspection criteria for: motors; controls; filters and any other maintenance items.
 - d) Provide instructions for minor repairs or adjustments required for preventive maintenance routines. Identify test points and give values for each. Include sensor calibration requirements and methods by sensor type.
 - e) Corrective maintenance instructions shall be predicated upon a logical effect-to-cause troubleshooting philosophy and a rapid replacement procedure to minimize equipment downtime.

- f) Troubleshooting: Troubleshooting tables, charts, or diagrams shall be used to present specified procedures. A guide to this type shall be a three-column chart. The columns shall be titled: malfunction, probable cause and recommended action.
 - g) Repair and Replacement: Indicate repair and replacement procedures most likely to be required in the maintenance of the equipment.
 - 6) Safety Precautions: This subsection shall comprise a listing of safety precautions and instructions to be followed before, during and after making repairs, adjustments or routine maintenance.
 - 7) Manufacturers' brochures (including controls): Manufacturers' descriptive literature covering devices and equipment used in the system, together with illustrations, exploded views and renewal parts lists. Manufacturers' standard brochures and parts list shall be corrected so that information applying to the actual installed equipment is clearly defined.
 - 8) Supply any special tools required to service or maintain the equipment.
 - 9) Performance data, ratings and curves.
 - 10) Warranty and guarantee, which clearly lists conditions to be maintained to keep warranty in effect and conditions that would affect the validity of the warranty.
 - 11) Any service contracts issued.
- d. Supplemental Data. Prepare written text and/or special drawings to provide necessary information, where manufacturer's standard printed data is not available and information is necessary for a proper understanding and operation and maintenance of equipment or systems, or where it is necessary to provide additional information to supplement data included in the manual or project documents.
- e. Control Diagrams/Drawings. Include the as-built control diagrams/drawings for the piece of equipment and its components, including full points list, full print out of all schedules and set points after testing and acceptance of the system, and copies of all checkout tests and calibrations performed by the contractor (not commissioning tests).
- f. Specifications. This section is comprised of the component or system specification section copied and inserted complete with all addenda.
- g. System Description. This section shall include the individual equipment portion of the overall system Design Basis Narrative.

E. Commissioning Record in O&M Manuals.

- 1. The CA 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 CM, to be included with the O&M manuals.
 - a. Commissioning Plan
 - b. System reports including design narratives and criteria including sequences. Each system shall contain the startup plan and report, approvals, corrections, construction checklists, completed performance tests, trending and analysis, training plan and recommended recommissioning schedule.

- c. Final Commissioning Report including 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. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas:
- 1) equipment meeting the equipment specifications
 - 2) equipment installation
 - 3) performance and efficiency
 - 4) equipment documentation and design intent
 - 5) operator training.

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 performance test, inspection, trend log, etc. where the deficiency is documented.

The 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.

END OF SECTION 01 9113

SECTION 019115- COMMISSIONING PLAN

PART 1 - GENERAL

1.1 COMMISSIONING PLAN OVERVIEW

- A. The Project Commissioning Plan provides a general description of the commissioning process to be used for the Stony Brook University – Tabler Quad New Residence Hall. The goals, intent, requirements, and timing of the process are included in the plan to provide a guide on how the process is to be executed and documented. The Project Commissioning Plan shall be supplemented and enhanced by the Commissioning Authority (CA), Construction Manager (CM), and other contractors throughout the construction process to form the Project Commissioning Record at the end of the project. Throughout the commissioning process, the CA will revise the specific commissioning procedures and forms as necessary to suit project field conditions and actual approved manufacturer's equipment, to incorporate test data and procedure results, and to provide detailed scheduling for all commissioning tasks. The completed Commissioning Plan shall become the owner's Commissioning Record and shall provide a reference to system setup, test results, and operational data for the systems commissioned. Once complete and approved, the Project Commissioning Record is then re-organized and combined with other project closeout documentation to form the Systems Manual for the project.

1.2 ABBREVIATIONS AND DEFINITIONS

The following are common abbreviations and definitions used in this document and throughout the commissioning process documentation:

A/E	Architect/Design Engineers	TP	Test Procedure
CA	Commissioning Authority	GC	General contractor
CC	Controls contractor	MC	Mechanical contractor
Cx	Commissioning	CC	Construction Checklist
CM	Construction Manager	OR	Owner's representative
Cx Plan	Commissioning Plan	Subs	Subcontractors to GC
EC	Electrical contractor	TAB	Test and balance contractor
FM	Facility Manager	MS	Maintenance Staff

- A. Acceptance: A contractually defined action that permits an activity to commence or continue.
- B. Basis of Design: A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements 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: A quality-oriented process for achieving, verifying and documenting that the performance of the facilities, systems and assemblies meet defined objectives and the Owner's Project Requirements. The commissioning process integrates and enhances the traditionally separate functions of design peer review, design and construction coordination, equipment startup, control system calibration, testing, adjusting and balancing, equipment documentation and facility staff training, and adds the activities of documented functional testing and verification.
- D. Commissioning Activity: A component of the Commissioning Process.
- E. Commissioning Authority: An entity identified by the owner who plans, schedules, and coordinates the commissioning team to implement the Commissioning Process.
- F. Commissioning Field Report: A document that records the activities and results of the Commissioning Process.
- G. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.
- H. Commissioning Process: A quality-focused process for enhancing the delivery of a project. The process focuses on verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.
- I. Commissioning Process Progress & Approval Form: A document that indicates activities completed as part of the Commissioning Process, approval status of the activities, and significant findings from those activities; it is continuously updated during the course of a project.
- J. Commissioning Team: The individuals, who through coordinated actions, are responsible for implementing the Commissioning Process.
- K. Coordination Drawings: Drawings showing the work of all trades to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances.
- L. Issues Log: A formal and ongoing record of problems or concerns – and their resolution – that have been raised by members of the Commissioning Team during the course of the Commissioning Process.
- M. Owner's Project Requirements: A written document that details the functional requirements of a project and the expectations of how it will be used and operated. This includes project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.
- N. Systems Manual: A system-focused composite document that includes the Commissioning Record, operation manual, maintenance manual, and additional information of use to the owner during the Occupancy and Operations Phase.

- O. Test Procedure: A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.
- P. Training Plan: A written document that details the expectations, schedule, budget, and deliverables of Commissioning Process activities related to training of project operating and maintenance personnel, users, and occupants.
- Q. Verification: The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project Requirements.

PART 2 - COMMISSIONING PLAN

2.1 COMMISSIONING PROCESS DESCRIPTION

- A. The Commissioning Plan is a document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.
- B. The contractor verifies installation, provides scheduling and coordination of commissioning activities, performs training, starts up equipment, conducts test, corrects deficiencies, performs re-tests. The Commissioning Authority (CA) provides the owner an unbiased, objective view of the systems installation, documentation, operation, and performance. Commissioning procedures and results are observed and documented by the CA. The contractor is expected to verify the functional readiness of systems to be tested prior to performing the tests. A high rate of test failure will indicate that the contractor has not adequately verified the readiness of the systems.
- C. Commissioning activities in the Construction Phase shall proceed from lower to higher levels of complexity. For each discrete subsystem or system, testing at the lower level shall be completed prior to starting the next higher level of tests. In general, the order of testing from lowest to highest is as follows:
 - 1. Static tests (such as duct leakage tests)
 - 2. Completion of pre-functional (static) checklists
 - 3. Start-up
 - 4. Control point-to-point checks
 - 5. Balancing
 - 6. System Test Procedures
 - 7. Intersystem Functional Performance Tests

2.2 PRE-DESIGN PHASE

- A. Commissioning Scoping Meeting
 - 1. The scoping meeting brings together all members of the design, construction, and operations team that will be involved in the commissioning process. In attendance are the respective representatives of the GC, CM, CA, PM, A/E and the mechanical, electrical, controls, and TAB subs. Each system to be commissioned is addressed, including commissioning requirements, and completion and start-up schedules. During the scoping meeting, all parties agree on the scope of work,

tasks, schedules, deliverables, and responsibilities and lines of reporting and communication for implementation of the Commissioning Plan. A commissioning scoping meeting is planned and conducted by the CA before the beginning of construction. Prior to this meeting the CA is given, by the GC, all drawings and specifications and the construction schedule by trade.

2. The CA finalizes the draft Commissioning Plan using the information gathered from the scoping meeting. The initial commissioning schedule is also developed along with a detailed timeline. The timeline is fine-tuned as construction progresses.

B. Owners Project Requirements

1. The OPR, relative to the building systems selected for commissioning, will be documented in order to establish a baseline of performance expectations to which the actual installed performance is compared. The CA, with the assistance of the FM, CM, OR and A/E, discusses the Basis of Design Summary that documents the OPR for those building systems selected for commissioning. The OPR Summary reflects the underlying assumptions and requirements that become represented in the construction documents.

2.2 DESIGN PHASE

- A. The Commissioning Plan is a living document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

- B. The Commissioning Plan serves as the road map for executing the process during the Construction and Occupancy and Operations Phases. The plan is continuously updated and added to until the end of the project, when it then become the Project Commissioning Record.

C. Basis of Design

1. The Basis of Design (BOD) is a document that records the concepts, calculations, decisions, and product selections used in the design to meet the Owner's Project Requirements 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.

D. Training Requirements

1. Training requirements are established during the Design Phase and are incorporated into the project specifications for each system that requires training.

E. Systems Manual Requirements

1. Content and format for the Systems Manual is determined in this phase. The requirements for the Systems Manual are incorporated into the project specifications.

F. General Review of Drawings and Specifications

1. The commissioning authority, along with the traditional design team members, reviews the full set of Construction Documents and specifications when DD is complete and again at approximately 100% completion. The A/E provides the necessary documents to the commissioning authority.
2. The commissioning authority compares the design with the interests and needs of the owner as identified in the OPR.
3. The Commissioning Authority is not responsible for design concept, design criteria or compliance with codes. The Commissioning Authority does not verify the designers' calculations or proof schematics or layouts in detail. The Commissioning Authority uses his or her knowledge to provide input into the areas checked. For example, the commissioning authority does not verify appropriate pipe or duct sizing, but may provide comments on unusually tight or restrictive duct layouts and bends or a poor location of a static pressure sensor.
4. The Commissioning Authority provides a copy of the review comments to the A/E and the owner. The A/E provides a written response to the commissioning authority and owner as to how the comments will be reflected in the final bid documents.

G. Commissioning Issues Log

1. Also known as deficiency or non-conformance reports, Commissioning Issues provide a record of issues that are discovered through the commissioning process so that they may be tracked and appropriately resolved. The Commissioning Issues Log is a formal and ongoing record of problems or concerns – and their resolution – that have been raised by members of the Commissioning Team during the course of the commissioning process that synthesizes the issues recorded on the Commissioning Issues form. Design review comments are included in the Issues section to track issues raised during the design process separately from the Construction Phase issues. Commissioning Issues forms are completed during the Construction and Occupancy and Operations Phases to track concerns raised during the commissioning process. The Issues Log then synthesizes the issues and provides issue status at-a-glance.

2.3 DEVELOPMENT OF COMMISSIONING CONTRACT DOCUMENTS

A. Commissioning Specifications

1. Commissioning contract documents are developed during the design process and include commissioning specifications and commissioning procedures. References are also developed for the technical specification sections to integrate the commissioning process with the project technical requirements. The process is intended to be integrated with the normal construction process and check, test, and start-up activities.

B. Pre-functional Checklists, Tests and Startup

1. Pre-functional Checklists are important to ensure that the equipment and systems are connected and operational and that performance testing may proceed without

- unnecessary delays. Each piece of equipment receives full checkout by the contractor. No sampling strategies are used.
2. The pre-functional Checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., fan belt tension, labels affixed, gages in place, sensor calibration, etc.).

PART 3 - DEVELOPMENT OF TEST PROCEDURES

3.1 OVERVIEW

- A. Functional testing is the dynamic testing of systems (rather than just components) under full operation. 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 of the control system's sequences of operation and components are verified to be responding as the sequences state. The CA develops the Test Procedures in a sequential written form and tests and documents the actual performance.

3.2 DEVELOPMENT PROCESS

- A. Before Test Procedures are written, the CA will require all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, control sequences and set-points. The CA develops specific Test Procedures to verify proper operation of each piece of equipment and system, using the information required in the Specifications and the representative start-up procedures required by the manufacturer. The CA will obtain information as needed and required by the specifications from the owner, as needed, regarding sequences and operation, manufacturers start up reports and test and balance reports to develop these tests.
- B. Functional 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 or by stand-alone data loggers. The CA will follow the specifications and use judgment where needed to determine which method is most appropriate. According to the specifications, not all pieces of identical equipment receive in-depth testing.

3.3 OVERVIEW AND PROCESS

- A. Execution of Functional Testing Procedures
 1. For any given system, prior to performing functional testing, the CA will either wait until the CC has been submitted with the necessary signatures, confirming that the system is ready for functional testing or complete the CC with owner's personnel as required. The contractor performs the testing and the CA oversees witnesses and documents the functional testing of all equipment and systems according to the Specifications and the OPR. The control system is tested before it is used to verify performance of other components or systems. 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 and finally to interlocks and connections between systems.

B. Pre-Requisites for Functional Performance Testing

The following applicable prerequisite checklist items are required to be listed on each written test form and be completed and checked off by the Commissioning Authority (CA) prior to functional testing.

1. All related equipment has been started up and start-up reports have been submitted and approved by the A/E and pre-functional checklists have completed and deficiencies corrected by the contractor.
2. All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final set-points and schedules with debugging, loop tuning and sensor calibrations completed.
3. Piping system flushing complete and required report approved.
4. Water treatment system complete and operational.
5. Test and balance (TAB) complete and approved for the hydronic and air system.
6. All A/E punchlist items for this equipment corrected.
7. Safeties and operating ranges reviewed by Operations.
8. Test requirements and sequences of operation attached.
9. Schedules and set-points attached.
10. Sufficient clearance around equipment for servicing.
11. Record of all values for pre-test set-points changed to accommodate testing has been made and a check box provided to verify return to original values (control parameters, limits, delays, lockouts, schedules, etc.).
12. Other miscellaneous checks of the pre-functional checklist and start-up reports completed successfully

PART 4 - CONSTRUCTION PHASE

4.1 SUBMITTALS

The general contractor will provide the CA with a set of equipment and system submittals. This equipment data includes installation and start-up procedures, O&M data, performance data and temperature control drawings. The subcontractors, GC or A/E notify the commissioning authority of any new OPR or operating parameter changes, added control strategies and sequences of operation, or other change orders that may affect commissioned systems.

4.2 SITE OBSERVATIONS

The CA makes periodic site visits to witness equipment and system installations. Each site visit will have a specific agenda and will be coordinated with the general contractor site supervisor. The CA attends selected planning and job-site meetings in order to remain informed on construction progress and to update parties involved in commissioning. The GC provides the CA with information regarding substitutions or change orders that may affect commissioned equipment or the commissioning schedule.

4.3 START-UP PLAN

- A. At a time designated by the owner, all Work required to be commissioned shall be operated by the contractor to demonstrate to the owner compliance with the OPR and Contract Documents. The contractor shall provide all materials, test equipment, utilities, etc., and sufficient responsible and knowledgeable personnel from each related trade as required demonstrating proper systems' operation.
1. This start-up test shall be in addition to the requirements for contractor tests, Code official's inspection tests, Authority having jurisdiction requirements and operating instructions.
 2. The contractor shall supervise, conduct, and document the start-up tests. The date for the start-up tests shall be prior to the anticipated date of substantial completion and in sufficient time to permit proper and full execution of the tests prior to that date. Any adjustments and/or alterations which the start-up tests indicate as necessary for the proper functioning of all equipment shall be completed prior to the date of substantial completion.
 3. The contractor shall provide a detailed schedule of completion indicating when each system is to be completed and outlining when and how tests will be performed. Completion schedule and Test Procedures shall be submitted for review at least 60 days prior to the anticipated date of system start-up.
 4. The scope of start-up tests shall include, as a minimum, a complete and fully automatic demonstration of the sequences of controls. The demonstration shall simulate seasonal or climate-based initiation of sequences.
- B. All work shall be operated properly with all systems balanced and all controls adjusted.
1. Work found not operating in accordance with the requirements specified in the Contract Documents shall be corrected and additional start-up tests made, all at no additional cost to the owner.
- C. The contractor shall submit the following required certificates and documents to the CM/OR at least thirty days prior to the start-up tests, unless otherwise noted:
1. O&M manuals submitted.
 2. Record drawings submitted.
 3. On-site operating instructions and factory start-up complete and specified documentation submitted.
 4. Testing, adjusting, and balancing reports submitted.
 5. Thorough cleaning of all systems, equipment and spaces.
 6. All systems' pressure tests complete.
 7. All systems' identification complete.
 8. All air distribution materials installed.
 9. Lubrication of all moving parts complete.
 10. Adjustment of all belt drive tensions complete.
 11. All non-automatic instrumentation installed and operating.
 12. All refrigeration systems leak-tested, evacuated, charged and oiled.
 13. Clean filters installed.
 14. All strainers and solids separators cleaned.
 15. All electrical connections complete and equipment operating.
 16. BAS control systems complete, calibrated, adjusted and operating correctly.

17. Water treatment and filtration systems complete and operating.
18. All field report and punchlist work complete.

- D. The contractor is to furnish start-up data sheets for all systems and associated equipment furnished by others which are interconnected with the work provided by the contractor including kitchen refrigeration systems and kitchen exhaust hood systems. The contractor shall submit start-up procedures, data sheets and recording forms for review a minimum of four weeks prior to execution of the start-up verification process. The start-up data sheets and recording forms shall be in the form required by the manufacturer of if not available by the CA with appropriate entries on each form for the contractor, Owner's Representative, CA, Architect and Engineer to initial witnessing of the start-up procedures.

4.4 VERIFICATION DURING THE CONSTRUCTION PHASE

- A. Verification is a systematic process of ensuring that all building systems perform interactively according to the OPR and operational needs. This is achieved by beginning in the Construction Phase and continuing through the occupancy and operations period with actual verification of performance prior to occupancy.
- B. Verification during the construction of this project is intended to achieve the following specific objectives according to the Contract Documents:
1. Ensure that applicable equipment and systems are installed properly and receive adequate operational checkout by installing contractors.
 2. Verify and document proper performance of equipment and systems.
 3. Ensure that O&M documentation is complete.
 4. Verify and document that systems and assemblies perform according to the OPR.
 5. Verify that adequate and accurate system and assembly documentation is provided to the owner.
 6. Verify that operation and maintenance personnel and occupants are properly trained.
 7. Utilize quality-based sampling techniques to detect systemic problems.
 8. Verify proper coordination among systems and assemblies.

4.5 COMMISSIONING RECORD

- A. The Project Commissioning Record is the original Project Commissioning Plan updated throughout the project and augmented with completed checklists, Test Procedures and data, and other attachments and reports collected through the commissioning process. The Commissioning Record is incorporated in the final project Systems Manual.

PART 5 - OCCUPANCY AND OPERATIONS PHASE

5.1 COMMISSIONING ISSUES AND RETESTING

- A. The CA record the results of the functional test on the procedure or test form. All deficiencies identified during the verification testing are documented on an issues list standard form and reported to the owner. The deficiency report includes all details of the components or systems found to be non-compliant with the parameters of the test plans.

The report details the adjustments or alterations required to correct system operation, at which time owner will identify the responsible party.

B. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA with the concurrence of the owner. In such cases the deficiency and resolution will be documented on the procedure form. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.

C. For identified deficiencies:

1. If there is no dispute on the deficiency and the responsibility to correct it:
2. The CA documents the deficiency and the adjustments or alterations required to correct it. The contractor corrects the deficiency and notifies the CA that the equipment is ready to be retested. The CA reschedules the test and the test is repeated.
3. If there is a dispute about a deficiency or who is responsible:
4. The deficiency is documented on the issues form and a copy given the CM/OR. Resolutions are made at the lowest management level possible. Final interpretive authority is with the CM/OR and the A/E. The CA documents the resolution process.
5. Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency and notifies the CA that the equipment is ready to be retested. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.

D. Deferred Testing:

1. Unforeseen Deferred Tests: If any test cannot be completed due to the building structure, required occupancy condition, or other deficiency, the functional testing may be delayed upon approval of the owner. These tests are conducted in the same manner as the seasonal tests as soon as possible.
2. Seasonal Testing: Seasonal variation in operations or control strategies may require additional testing during the opposite season to verify performance of the HVAC system and controls. During the warranty period, seasonal testing and other deferred testing is completed as required to fully test all sequences of operation. Operation coordinates these activities. Tests are executed and documented, with deficiencies corrected by the appropriate contractors. Any final adjustments to the O&M manuals and as-builts due to the testing are also completed.

5.2 FACILITY STAFF PARTICIPATION

The facilities operating staff at the direction of the owner may participate in the testing process.

5.3 SAMPLING

At the discretion of the CA, multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy.

5.4 SEQUENCE OF TESTING

1. The verification of the Construction Checklists begins with equipment or assembly delivery and continues through start-up and testing.
2. Tests verifying system and inter-system performance according to the Owner's Project Requirements cannot begin until the Construction Checklists have been verified and accepted by the Commissioning Team.
3. Other sequencing requirements, depending upon the specific system, may be required to ensure the proper conditions are present or can be created.
4. A specified test is run per construction documents or per manufacturer's requirements.

5.5 STANDARD O&M MANUALS

- A. As part of the commissioning process, the CA reviews the O&M manuals, documentation and redline as-builts for systems that were commissioned to verify compliance with the OPR and Specifications. The CA will review each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated.

- B. Systems Manual

The Systems Manual is intended to be a usable information resource containing all of the information related to the systems, assemblies, and commissioning process in one place with indexes and cross references.

- C. Commissioning Report

1. After completion of all commissioning activities, the Commissioning Authority will write a final report documenting the overall results of the commissioning process and recommending acceptance of the commissioning process and related documentation to the owner.
2. The final commissioning report will include an overview or summary of the commissioning process, major results of the process, the final commissioning issues log and resolutions, commissioning progress and field reports, a deferred testing log, an unresolved issues log, a lessons-learned evaluation, and concluding with a recommendation to accept the process as complete.

5.6 SCHEDULE REQUIREMENTS

The following sequential priorities are followed:

1. Equipment is not "temporarily" started (for heating or cooling), until installation checklist items and all manufacturers' pre-start procedures are completed and moisture, dust and other environmental and building integrity issues have been addressed.
2. System verification testing is not begun until Pre-functional (Construction) Checklists and start-up and TAB is completed, for a given system. System ready to balance checklist must be submitted to Operations.
3. The controls system and equipment it controls are not functionally tested until all points have been calibrated and Construction Checklists are completed.

4. TAB is not performed until the controls system has been started, sufficiently functionally tested, and approved by the A/E.
5. TAB is not performed until the envelope is completely enclosed and ceilings are complete, unless the return air is ducted.

5.7 GENERAL MANAGEMENT PROTOCOLS

Issue	Protocol
For requests for information (RFI) or formal documentation requests:	The CA goes first through the CM or OR
For minor or verbal information and clarifications:	The CA goes direct to the CM or OR
For notifying contractors of deficiencies:	The CA documents deficiencies through the CM or OR, but may discuss deficiency issues with contractors prior to notifying the CM or OR
For scheduling tests or training:	The CA provides input and coordination of testing and training. Scheduling is done through the CM or OR.
For scheduling commissioning meetings:	The CP selects the date and schedules through the CM or OR.
For making a request for significant changes:	The CA has no authority to issue change orders.
For making minor changes in specified sequences of operations:	Any required changes in sequences of operations required to correct operational deficiencies must be approved and documented by the CM/OR and A/E team. The CA may recommend changes in sequences of operation to improve efficiency or control.
Subcontractors disagreeing with requests or interpretations by the CA shall:	Resolve issues at the lowest level possible. First with the CA, who obtains approval from the CM or OR then with the GC. Some issues may require input from the A/E team.

PART 6 - ROLES AND RESPONSIBILITIES

Descriptions and explanations of the roles and responsibilities of those in the commissioning process are found below and in the Contract Documents:

A. General Descriptions of Roles

General descriptions of the commissioning roles are as follows:

CA: Coordinates the Cx process, writes Construction Checklists and test

Procedures and reviews testing plans, start-up procedures and directs and documents performance testing.

OR: Facilitates and supports the Cx process and gives final approval of the Cx work.

FM: Coordinates maintenance staff participation in commissioning activities.

GC: Facilitates the Cx process, ensures that Subs perform their responsibilities and integrates Cx into the construction process and schedule.

Subs: Demonstrate correct system performance.

Staff: Participate in commissioning tasks and performance testing, review O&M documentation, and attend training.

A/E: Perform construction observation, approve O&M manuals and assist in resolving problems.

Mfr.: Equipment manufacturers and vendors provide documentation to facilitate the commissioning work and perform contracted startup.

B. Specific Roles and responsibilities

Owner's Representative (OR):

1. Assign operations and maintenance personnel and schedule them to participate in the various meetings, training sessions, and observations/inspections as follows:
 - a. Construction Phase coordination meetings.
 - b. Initial owner training session at initial placement of major equipment.
 - c. Maintenance orientation and inspection.
 - d. System testing verification meetings.
 - e. Procedures meeting for testing systems.
 - f. Owner's training session.
 - g. Verification demonstrations.
 - h. Systems and assemblies tests.
 - i. Final review at acceptance meeting.
2. Review and approve any changes made to Owner's Project Requirements.
3. Review and approve the Construction Documents.
4. Provide qualified personnel for videotaping and editing of training sessions.
5. Review and comment on the Commissioning Authority's Commissioning Process Progress Reports.
6. Review and comment on the Commissioning Authority's verification reports.
7. Review and accept the Commissioning Authority's Commissioning Process Report.

Commissioning Authority (CA):

1. Participate in the pre-bid meeting
2. Organize and lead the Commissioning Team.
3. Identify specialists who will be responsible for accomplishing the Commissioning Process activities for specific systems and assemblies
4. Provide Commissioning Process activities to the GC for inclusion into the project schedule

5. Update the Design Phase Commissioning Plan that describes the extent of the commissioning process to accomplish the Owner's Project Requirements. Update the Commissioning Plan to incorporate changes and additional information.
6. Execute the Commissioning Process through the writing and review of Commissioning Process Reports, organization of all Commissioning Team meetings, tests, demonstrations, and training events described in the Contract Documents and approved Commissioning Plan.
7. Organizational responsibilities include preparation of agendas, attendance lists, and arrangements for facilities, and timely notification to participants for each Commissioning Process activity.
8. The Commissioning Authority shall act as chair at all commissioning events and ensure execution of all agenda items.
9. The Commissioning Authority shall prepare minutes of every Commissioning Process activity and send copies to all Commissioning Team members and attendees within five workdays of the event.
10. Schedule the pre-construction Commissioning Process meeting within 30 days of the award of the contract at some convenient location and at a time suitable to the attendees. This meeting will be for the purpose of reviewing the complete Commissioning Process and establishing tentative schedules for the Construction Phase commissioning activities.
11. Develop and verify completion Construction Checklists.
12. Review the following submittals: coordination drawings, shop drawings, product data, and training program for compliance with the Owners Project Requirement.
13. Review and recommend approval of contractor's start-up plan.
14. Develop Test Procedures to carry out the tests that are accomplished during this phase.
15. Develop the initial format to be used for Issues Logs throughout and for each phase of the Commissioning Process.
16. Facilitate the scheduling of the initial owner training session so that it will be held immediately before the contractor training. This session will be attended by the owner's O&M personnel, the design professionals, the contractor, and the Commissioning Authority. The Commissioning Authority will review the Owner's Project Requirements and the design professionals will review the Basis of Design.
17. Review proposed contractor-provided training program to verify that the Owner's Project Requirements are achieved.
18. Attend a portion of the contractor-provided training sessions to verify that the Owner's Project Requirements are achieved.
19. Update the Systems Manuals to incorporate materials generated during the Construction Phase. Update material that originated in earlier phases of the project. Add new materials such as the following to the manuals, such as Test Procedures and test data records, training plans, training records and record drawings. Verify that it achieves the Owner's Project Requirements. Insert systems descriptions as provided by the design professional(s) in the Systems Manual.
20. Witness system and assembly testing. Verify the results and include a summary of deficiencies.
21. Identify diagnose, and track issues and deviations relating to the Construction Documents and the Owner's Project Requirements and document resolution of same.

22. Supervise the Commissioning Team members in completion of tests. The test data will be part of the Commissioning Process Report.
23. Periodically review Record Drawings for accuracy with respect to the installed systems. Request revisions through the owner to achieve accuracy.
24. Verify that the Systems Manual and all other design and construction records have been updated to include all modifications made during the Construction Phase.
25. Repeat implementing of tests to accommodate seasonal tests or to correct any performance deficiencies. Revise and resubmit the Commissioning Process Report as required.
26. Prepare the final Commissioning Process Report.
27. Update the Basis of Design to reflect any changes to the design during the Construction Phase. Verify that design changes comply with the Owner's Project Requirements. If necessary, update the Owner's Project Requirements.
28. Assemble the final documentation, which includes the Commissioning Process Report, the Systems Manual, and all record documents. Submit this documentation to the owner for review and acceptance.
29. Recommend acceptance of the individual systems and assemblies to the owner (in accord with the defined project requirements).
30. Keep the Commissioning Team informed of decisions that result in modifications to the Owner's Project Requirements.

Design Professional (A/E):

1. Document the Basis of Design.
2. Attend the pre-construction meetings as scheduled by the Commissioning Authority.
3. Review and incorporate as appropriate the Commissioning Authority's comments from submittal reviews.
4. Participate in the initial operation and maintenance personnel and occupant training session by presenting the project Basis of Design.
5. Participate in other training as detailed in the training program.
6. Review Test Procedures submitted by the Commissioning Authority.
7. Review and comment on the Commissioning Authority's periodic Commissioning Process Progress Reports and Issues Log reports.
8. Review and accept record documents as required by Contract Documents.
9. Review and comment on the final Commissioning Process Report.
10. Recommend final acceptance of the systems to the owner.

Construction Manager (CM):

1. Include Commissioning Process requirements and activities in all contractors' contracts.
2. Provide acceptable representation with the means and authority to prepare and coordinate implementation of the Commissioning Process as detailed in the Contract Documents.
3. Issue a statement certifying that all work has been completed and that the facility is operational, in accordance with Contract Documents.
4. Issue the appropriate final reports to the design professionals for review and acceptance.

5. Facilitate the remedy of deficiencies identified by the Commissioning Authority during verification of the installation or testing.
6. Review and comment on the final Commissioning Process Report.

Contractor (GC):

1. Include Commissioning Process requirements and activities in each purchase order or subcontract written.
2. Obtain cooperation and participation of all subcontractors and manufacturers.
3. Attend the pre-construction and Commissioning Team meetings.
4. Include Commissioning Process milestones in the project schedule.
5. Implement the training program as detailed in the Contract Documents.
6. Provide submittals to the owner, design professionals, and the Commissioning Authority.
7. Notify the Commissioning Authority when systems and assemblies are ready for testing.
8. Demonstrate the performance of assemblies and/or operation of systems to the Commissioning Authority.
9. Complete the Construction Checklists as the work is accomplished. Provide the completed Construction Checklists to the Commissioning Authority through the owner.
10. Continuously maintain the Record Drawings and submit as detailed in the Contract Documents.

Manufacturers, Vendors, Suppliers (Mfr.):

1. Provide all information required for the operation and maintenance of the system or assembly as part of the initial submittal.
2. Provide the requirements to maintain the warranty as part of the initial submittal.
3. Coordinate and accomplish factory tests as detailed in the Contract Documents.
4. Provide training as detailed in the training program contained in the Contract Documents.
5. Demonstrate operation and performance of the system or assembly as detailed in the Contract Documents.

PART 7 - COMMISSIONED SYSTEMS

A. The following systems and assemblies will be commissioned:

1. Mechanical, including HVAC&R equipment and controls
2. Plumbing, including domestic hot water systems, pumps and controls
3. Electrical, including service, distribution, lighting, and controls, including daylighting controls
4. Energy and performance measurement and monitoring systems and equipment
5. Building envelope

END OF SECTION 01 9115

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including general and supplementary conditions and Division 1 specification sections, apply to this section.
- B. Concrete paving and walks are specified in Division 32.
- C. Section 03 3020: Concrete Slabs on Grade and Metal Deck.
- D. Waterproofing is specified in Division 7.

1.2 DESCRIPTION OF WORK

- A. This section specifies cast-in-place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. ACI 117 "Specification for Tolerances for Concrete Construction and Materials"
 - 2. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete."
 - 3. ACI 301 "Specifications for Structural Concrete for Buildings."
 - 4. ACI 303 "Guide to Cast-in-Place Architectural Concrete Practice."
 - 5. ACI 304 "Guide for Measuring, Mixing, Transporting, and Placing Concrete"
 - 6. ACI 305 "Hot-Weather Concreting."
 - 7. ACI 306R "Cold-Weather Concreting."
 - 8. ACI 311 "ACI Manual of Concrete Inspection" and "Guide for Concrete Plant Inspection and Testing of Ready-Mixed Concrete."
 - 9. ACI 315 "Details and Detailing of Concrete Reinforcement."
 - 10. ACI 318 "Building Code Requirements for Structural Concrete."
 - 11. ACI 347 "Guide to Formwork for Concrete."
 - 12. ACI SP-15 "Field Reference Manual." A copy of this publication shall be kept in the field office at all times during concrete construction.
 - 13. AWS D1.4 "Structural Welding Code - Reinforcing Steel."
 - 14. p
 - 15. NYSDOT "Standard Specification for Construction and Materials."
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed

Concrete Production Facilities.”

- C. Source Limitations: To minimize irregularities in appearance or color, obtain cementitious materials of the same brand from the same manufacturer's plant. Obtain aggregates, admixtures, and water for each type of concrete construction exposed to view in completed project from same source for duration of that type of construction.
- D. Mockups: For architecturally exposed concrete finishes, cast sample panels in nonexposed locations for review and acceptance by Architect.
 - 1. Use materials, joints, surface finish, texture, tolerances, and standard of workmanship which are to be used in exposed areas.
 - 2. Architecturally exposed concrete shall be considered to include exposed concrete except in service spaces such as mechanical rooms, electrical rooms, and other utilitarian spaces.
 - 3. Build panel approximately 100 square feet in location indicated or as directed by Architect.
 - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Pre-installation Conference: Refer to Specification Section 014533 and Schedule of Special Inspections.
- F. Provide protection of newly cast concrete from direct exposure to sun, wind, precipitation, and excessive cold or hot temperatures starting during placement and lasting until end of curing period.
 - 1. Contractor shall be responsible for cost or repairing defects resulting from deficient protection methods.

1.4 SPECIAL INSPECTIONS

- A. Refer to Specification Section 014533 and Schedule of Special Inspections.

1.5 MATERIAL EVALUATION/QUALITY CONTROL

- A. Preconstruction Testing: Contractor shall employ Testing Agency acceptable to Engineer and Architect to perform material evaluation tests and evaluate concrete mixes prior to submitting.
 - 1. Testing Agency shall be qualified according to ASTM C 1077 and ASTM E329.
- B. Submit concrete testing service qualifications demonstrating experience with similar projects.
- C. Require concrete supplier to provide delivery tickets for each truckload of concrete. Tickets shall be presented to and reviewed by Contractor and Special Inspector or Testing Agency prior to discharging concrete into structure.

1. Tickets shall contain project identification name, name of Contractor, name of concrete supplier, location of batch plant, date and time of concrete batching, truck number, delivery ticket number, concrete type and class, concrete mix number, design compressive strength at 28 days, concrete mix proportions and materials, and amount of total mix design water that can be added at site prior to discharging into structure if total mix design water was not used when batched. See Part 3 of this section for maximum water amount that can be added at site.
 - D. The Registered Design Professionals (RDPs) for Structural Engineering and Architecture and the Special Inspector will visit construction site at appropriate intervals to determine if work is in general conformance with Contract Documents and specifications. Notify RDPs 48 hours before anticipated time of completion of reinforcement for a given section of work so they may determine if site observations are required. If site observations are required, do not place concrete until RDPs have had opportunity to observe reinforcement.
 - E. Concrete strength will be evaluated by compression testing in accordance with ASTM C39 as part of the Special Inspections. Test results shall be provided to the Contractor, Special Inspector, and Registered Design Professional (RDP) responsible for Structural Engineering. Evaluation and acceptance will be in accordance with the provisions of ACI 318, Section 26.12. Should evidence of low-strength concrete exist, or if test results indicate non-conformance with these specifications, additional investigation as outlined in ACI 318 Section 26.12.4 may be directed by the project Registered Design Professionals (RDP). All such investigation, including the cost of the Architect's and Engineer's time, shall be at the Contractor's expense.
 - F. If, after additional investigation, evidence of low-strength concrete still exists, load tests in accordance with Chapter 27 of ACI 318 may be ordered by the project Registered Design Professionals (RDP). In the event the concrete is determined to be inadequate by the project Registered Design Professionals (RDP), the Contractor shall remove it from the Project and replace it with concrete conforming to these specifications, subject to project Special Inspections and testing requirements herein. All such remedial work shall be at the Contractor's expense.
 - G. The Contractor shall be fully responsible for ensuring that all concrete and concrete placement are in accordance with the Project Specifications. Failure of project Registered Design Professionals (RDP) or Testing Laboratory to detect defective work, workmanship, or materials shall in no way prevent rejection and the Contractor taking accepted corrective action when such defects are discovered.
- 1.6 SUBMITTALS
- A. Shop Drawings:
 1. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Show bar sizes, lengths, material grade, schedules, spacing, diagrams of bent bars, arrangements of reinforcement, splices and laps,

mechanical connections, and supports for reinforcement. Include special reinforcement required for openings through concrete.

- a. Show elevations of reinforcement for all members at minimum 1/4 inch = 1 foot scale.
 - b. Show locations of construction and control joints.
 - c. Reference Contract Drawing number and addendum number in each shop drawing.
 - d. Do not place reinforcing information from more than one design discipline (structural, civil, landscape) in each drawing.
- B. Mix Designs: Submit proposed mix designs for concrete 15 days minimum before start of concreting. Submittal must be in the Concrete Mix Design Submittal Form at end of this section for each class of concrete.
- C. Submit to Special Inspector and Engineer material certificates signed by manufacturers certifying each material complies with specifications. Submit proposed admixtures including chloride ion content prior to submitting mix design.
- D. Submit data and installation instructions for proprietary materials.
- E. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel within this specification section, if available. A statement of the contractor's good faith effort to obtain the EPD shall be provided if not available.
1. Manufacturer provided EPDs must be Product Specific Type III (Third Party Reviewed), in adherence with ISO 14025 Environmental labels and declarations, ISO 14044 Environmental management Life cycle assessment, and ISO 21930 Core rules for environmental product declarations of construction products and services.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials so as to preserve their quality and fitness for work.
1. Store reinforcement and formwork in manner to prevent bending, damage (including damage to coatings) and accumulation of dirt.
 2. Store waterstops in a manner to prevent exposure to moisture, sunlight, dirt, oil, and other contaminants.

1.8 WORKMANSHIP

- A. Contractor shall be responsible for correction of concrete work not conforming to specified requirements, including strength, tolerances, and finishes. Correct deficient concrete as directed by Architect.
- B. Remove work found to be defective. Replace with new acceptable work.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed/plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown in drawings. Plywood materials shall be one of the following:
 - 1. Overlaid plywood complying with U.S. Product Standards PS 1 "A-C or B-B High Density Overlaid (HDO) Concrete Form," Class 1, exterior grade or better.
 - 2. Plywood complying with U.S. Product Standard PS 1 "B-B (Concrete Form) Plywood," Class 1, exterior grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match Architect's control sample. Provide solid backing and form supports to ensure stability of textured form liners.
- D. Forms for Cylindrical Columns and Supports: Metal, fiberglass-reinforced plastic, or paper or fiber tubes that will provide surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide paper or fiber tubes of laminated plies with water-resistant adhesive and wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.
- A. E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- B. F. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- G. Chamfer Strips: Wood, metal, PVC, or rubber strips, **3/4 by 3/4 inch** minimum.
- D. H. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- I. Form Release Agent: Provide commercial formulation form-coating compounds with maximum VOC of 450 g/l that will not bond with, stain, or adversely affect concrete surfaces or impair subsequent treatments of concrete surfaces requiring bond or adhesion or impede wetting of surfaces to be cured with water or curing compound.
 - 1. Formulate form release agent with rust inhibitor for steel form-facing materials.
- J. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off, metal form ties, designed to prevent form deflection and spalling concrete upon removal. Provide units that will leave no metal closer than 1 inch to exposed surface.
 - 1. Provide ties that will leave holes no larger than 1-inch diameter in concrete surface

- when removed.
2. Furnish ties with integral water-barrier plates or washers to walls indicated to receive dampproofing or waterproofing.
 3. Unexposed concrete: "Type A-3 Snap Tie Standard" by Dayton Superior or accepted equivalent.
 4. Exposed concrete: "Type A-3 Snap Tie Heavy" by Dayton Superior or accepted equivalent.
 5. Architectural exposed concrete: "Type B1 Two Strut Coil Tie" or "Type B1/B3 Screw-on Coil Tie," with coil bolts and plastic cones at each end, by Dayton Superior, or accepted equivalent. Provide "Type B30 Screw-on Plastic Cone or A54 Coil Cone Concrete Plugs," by Dayton Superior, or accepted equivalent; color as selected by Architect.
 6. Provide galvanized or stainless steel ties for concrete elements that are reinforced with epoxy-coated or galvanized reinforcing.
 7. Internal wood spreaders are prohibited.

2.2 REINFORCING MATERIALS

- A. Deformed bars: ASTM A 615, Grade 60.
- B. Deformed bars to be welded, ASTM A 706.
- C. Deformed Epoxy-Coated Reinforcing Bars: ASTM A 775.
- D. Deformed Galvanized Reinforcing Bars: ASTM A 767, Class I.
- E. Deformed Stainless-Steel Reinforcing Bars: ASTM A 955.
- F. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- G. Epoxy-coated Wire: ASTM A 884.
- H. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.
- I. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- J. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars in place. Use wire bar-type or all plastic-type supports complying with CRSI specifications. Use chairs with sand plates or horizontal runners where base material will not support chair legs.
 1. Concrete bricks may be used to support footing and pile cap reinforcing. Stagger brick locations on subgrade.
 - a. Do not use clay bricks.
 - b. Do not use bricks to support epoxy-coated or galvanized reinforcing.
 - c. Do not locate bricks or other supports on ends of piles.

2. Supports for epoxy-coated reinforcing shall be either wire bar-type coated with epoxy, plastic, or vinyl compatible with concrete for a minimum distance of 2 inches from the point of contact with reinforcing or all plastic-type.
3. Supports for galvanized reinforcing shall be either galvanized wire bar-type or all-plastic type.
4. Finish (epoxy-coated or galvanized) for supports formed from reinforcing bars shall match the finish of the supported reinforcing.
5. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are plastic-protected (CRSI, Class 1) or stainless-steel protected (CRSI, Class 2).

K. Minimum 16-gauge annealed tie wire, ASTM A 82.

1. Provide coated tie wire for use with epoxy-coated or galvanized bars. Acceptable coatings include epoxy, nylon, or vinyl. Galvanized tie wire may be used with galvanized bars. Do not use plain tie wire.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or II.

B. Aggregates: NYSDOT-approved, Section 703 (normal weight), one source and as specified.

1. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps, or other deleterious substances.
2. Coarse Aggregate: Clean, uncoated, processed aggregate free from clay, mud, loam, or foreign matter.
 - a. For footings, foundation walls, piers, grade beams, basement walls, retaining walls, and interior walls, blend of NYSDOT size 1 and 2 (25 percent size 1 and 75 percent size 2) or gradation conforming to ASTM C 33, size 467:

Sieve Size	Percent Passing
2 inch	100
1 1/2 inch	95 to 100
3/4 inch	35 to 70
3/8 inch	10 to 30
No. 4	0 to 5

- b. For other applications, blend of NYSDOT size 1 and 2 (40 percent size 1 and 60 percent size 2) or gradation conforming to ASTM C 33, size 57:

Sieve Size	Percent Passing
1 1/2 inch	100
1 inch	95 to 100
1/2 inch	25 to 60
No. 4	0 to 10
No. 8	0 to 5

c. No size requirement for stair-pan fill and lean concrete.

- C. Water: ASTM C 94, clean, fresh, drinkable.
- D. Fly Ash: ASTM C 618, Type F, with a loss on ignition of less than 6 percent.
- E. Ground-Granulated, Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- F. Silica Fume: ASTM C1240
- G. Reinforcement Couplers: "Lenton Concrete Products" by Erico; "Bar-Lock Rebar Coupler System" by Dayton Superior;

2.4 ADMIXTURES

- A. Air Entraining: ASTM C 260.
- B. Water-Reducing Admixture: "Eucon MR", "Eucon WR-75", or "Eucon WR-91" by Euclid Chemical Co.; "MasterPozzoloth 200" by Master Builders; or "Plastocrete 161" by Sika Chemical Corp. Admixture shall conform to ASTM C 494, Type A, and not contain more chloride ions than in municipal drinking water.
- C. Water-Reducing and Retarding Admixture: "Eucon Retarder-75" by Euclid Chemical Co; "MasterSet R100" by Master Builders; or "Plastiment" by Sika Chemical Corp. Admixture shall conform to ASTM C 494, Type D, and not contain more chloride ions than in municipal drinking water.
- D. Noncorrosive, Nonchloride Accelerator: ASTM C 494, Type C or E, and not contain more chloride ions than in municipal drinking water.
- E. High-Range, Water-Reducing Admixture (Superplasticizer): "Eucon 37" by Euclid Chemical Co. or "Sikament SPMN" by Sika Chemical Corp. Admixture shall conform to ASTM C 494, Type F or G, and not contain more chloride ions than in municipal drinking water.
- F. Polycarboxylate Polymer Superplasticizer for Self-Consolidating Concrete: "Eucon Plastol 341" by Euclid Chemical Co. or "Sika Viscocrete 2100" by Sika Chemical Corp, "MasterGlenium 7500" by Master Builders.
- G. Viscosity Modifier for Self-Consolidating Concrete: "Visctrol" by Euclid Chemical Co. or "MasterMatrix VMA 358 or 362" by Master Builders.
- H. Prohibited Admixtures: Calcium chloride, thiocyanates, and admixtures containing more than 0.05 percent water-soluble chloride ions by weight of cement or more than 0.3 percent thiocyanates by weight of cement shall not be permitted.
- I. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix design review by the Registered Design Professional responsible for Structural

Engineering.

2.5 RELATED MATERIALS

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 ounces a square yard when dry and complying with AASHTO M 182, Class 2.
- B. Curing-Sheet Materials: One of the following moisture-retaining covers, complying with ASTM C 171. Waterproof paper, polyethylene film, or polyethylene-coated burlap.
- C. Clear Curing and Sealing Compound (VOC compliant): ASTM C 309, Type 1, Class B with minimum 25 percent solids content. Provide test data from an Independent Testing Laboratory indicating a maximum moisture loss of 0.030 grams per square centimeter in 72 hours when applied at a coverage rate of 300 square feet per gallon. Sodium silicate compounds are not permitted. Use "Super Diamond Clear VOX" by Euclid Chemical Co. or accepted equivalent. Contractor to confirm if compatible with floor coatings and adhesives.
- D. Horizontal Joint Sealants: "MasterSeal SL2" by Master Builders; "Sikaflex-2c SL" by Sika Corp.; "Eucolastic 1 SL" by Euclid Chemical Co.; or accepted equivalent.
- E. Vertical Joint Sealants: "Eucolastic 1 NS" by Euclid Chemical Co.; "MasterSeal NP2" by Master Builders; "Sikaflex-2c NS" by Sika Corporation; or accepted equivalent.
- F. Joint Filler: ASTM D 1751, 1/2-inch-thick, premolded, expansion and isolation joint filler strips.
- G. Backer Rod: Polyethylene closed-cell foam. "MasterSeal 920 or 921" by Master Builders or accepted equivalent.
- H. Self-Expanding Butyl Strip Waterstops: "Waterstop-RX," 1 inch by 3/4 inch, by CETCO or accepted equivalent at below-grade wall construction joint locations and at locations shown in drawings.
- I. PVC Waterstops: Polyvinyl Chloride, dumbbell-type or center bulb-type, conforming to Corps of Engineers CRD-C 572. "Wirestop CR-6380" or "Wirestop FD-6380" by Paul Murphy Plastics Company; "Sealtight PVC Waterstop 6380" by W.R. Meadows; or accepted equivalent at below-grade wall control joint locations and at locations shown in drawings.
- J. Chamfer Strips: Provide wood, metal, PVC, or rubber chamfer strips fabricated to provide 3/4-inch chamfer on exposed edges.
- K. Reglets: Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.022-inch-thick (26-gauge) galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

- E. L. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than **0.034 inch (0.85 mm)** thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- M. Sleeves:
 - 1. Schedule 40, PVC for 12-inch diameter or smaller.
 - 2. ASTM A 53, hot-dip galvanized for larger than 12-inch diameter.
- N. Anchor Rods and Leveling Plates: Furnished in Section 05 1200 and installed under this section.
- O. Non-shrink Grout: Corp of Engineers CRD-C 621. "Sure-Grip High Performance Grout" by Dayton Superior; "NS Grout" by Euclid Chemical Co.; "SikaGrout 212" by Sika Corp.; "Masterflow 928" by Master Builders, Inc.; or accepted equivalent.
- P. Bonding Agent: ASTM C 1059, Type II "Acrylic Bonding Agent J40" by Dayton Superior; "SBR Latex" by Euclid Chemical Co.; "Everbond" by L&M Construction Chemicals, Inc.; "SikaLatex" by Sika Corp.; or accepted equivalent.
- Q. Chemical Adhesive for Doweled Reinforcement:
 - 1. Anchors to solid concrete, grouted CMU, solid brick, or stone:
 - a. Anchors for use when base material temperature is 0°F or greater: "HIT-Ice" by Hilti; "Epcon A7" by ITW Ramset/Red Head; "AC 100 + Gold" by Powers Fasteners; "AT-XP" by Simpson/Strong-Tie; or accepted equivalent.
 - b. Anchors for use when base material temperature is 40°F or greater; "HIT HY 200" by Hilti; "Epcon C6+" by ITW Ramset/Red Head; "PE 1000+" by Powers Fasteners; "ET-HP" by Simpson/Strong-Tie; or accepted equivalent.
- S. Expansion Joint: Preformed low density closed cell joint seal bonded in place with two component 100% solids modified epoxy adhesive. Working movement range minimum 60% compression, 30% tension, and 120% shear. "Wabo Evazote UV" by BASF; or accepted equivalent.

2.6 PROPORTIONING AND MIX DESIGN

- A. Prepare design mixtures for type and strength of concrete in accordance with ACI 301, section 4.2.2 and these specifications. Use independent testing facility acceptable to Architect for preparing and reporting proposed mix designs.
- B. Where concrete production facility can establish uniformity of its production for concrete of similar strength and materials based on recent test data, the average strength used as a basis for determining mix design proportions shall exceed specified design strength by requirements of ACI 301, Section 4.2.3.3(a).
- C. When a concrete production facility does not have field-test records for calculation of standard deviation, the required average strength shall be determined in accordance with ACI 301, Section 4.2.3.3(b).

- D. Documentation of average compressive strength shall comply with ACI 301, Section 4.2.3.4(a), 4.2.3.4(b), or 4.2.3.4(c). Submit sample standard deviation calculation and/or results of trial mixtures used as basis for determination of f'_{cr} . See Specification Section 1.6.B.

- E. Concrete Quality shall adhere to the following minimum requirements, unless noted otherwise on structural drawings:

Location	Exposure Category†	Maximum Aggregate Size	Required 28-day Compressive Strength psi	Maximum Water/Cement Ratio	Percent Entrained Air *
See drawings					

* Plus or minus 1.5 percent.

† ACI 318 Section 19.3.1

- F. Quantity of coarse aggregate in pounds must be in the range of 1.25 to 1.5 times quantity of fine aggregate in pounds.
- G. Admixtures: Structural concrete for columns, beams, and slabs shall contain the specified water-reducing admixture and/or high range water-reducing admixture (superplasticizer.) At the Contractor's option, both water-reducing admixtures may be included in the concrete mix. Concrete required to be air-entrained shall contain the accepted air entraining admixture. Pumped concrete, architectural concrete, and concrete with a water-cement ration less than 0.5 shall contain the specified high range water-reducing admixture (superplasticizer.)
- H. Slump:
1. Footings, frost/foundation walls, piers, grade beams, underpinning, misc. concrete: 3 inches to 5 inches.
 2. Retaining walls, basement walls, interior walls: 4 inches maximum.
 3. Concrete containing high-range, water-reducing admixture (superplasticizer) shall have a maximum slump of 9 inches unless otherwise accepted by Engineer.
 4. Type G superplasticizer may be added at plant if adequate quality control measures are implemented to verify slump and admixture quantities at plant before addition of superplasticizer. Concrete shall maintain required slump during transportation and placement. Quality control testing at plant shall be performed by an independent testing laboratory employed by Contractor and acceptable to Architect.
 5. Ready-Mix Concrete: ASTM C 94.
 6. Provide batch ticket for each batch discharged and used in work indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.
- I. Pozzolans:
1. Pozzolans may be substituted for cement in normal-weight concrete, including fly ash, ground-granulated blast-furnace slag, and/or silica fume.
 - a. Substitution rate of Pozzolans for Portland Cement in concrete classified as Exposure Category F3 shall be limited to: fly ash, at a maximum rate of 25

- percent by weight, ground-granulated blast-furnace slag at a maximum rate of 50 percent by weight, or silica fume at a maximum rate of 10 percent by weight.
- b. Proposed concrete mix designs containing a combination of fly ash, ground-granulated blast-furnace slag, or silica fume shall comply with the substitution limitations indicated in Table 26.4.2.2(b) of ACI 318.
- 2. LEED: Pozzolans substitution for cement in normal-weight concrete shall be documented as required by section 1.6 E.2 of this specification.
 - 3. Submittals shall include actual mix design, including percentage of pozzolans and test results showing mix meets specified 7-day compressive strength where indicated, 28-day compressive strength, and air content.
 - 4. Protect and heat concrete containing pozzolans during cold-weather conditions. Maintain protection and heat until 70 percent of specified design strength is achieved.
- J. Self-Consolidating Concrete Mix: ASTM C1611/C1611M and ASTM C1621/C 1621M:
- 1. Slump Flow: 24 inches to 30 inches.
 - 2. Visual Stability Index Rating: 1 or less. J-Ring Flow: Difference between slump flow and J-ring flow shall not be more than 2 inches.
- K. Pumped concrete: Submit mix designs specifically prepared and used previously for pumping. Mix designs not previously used for anticipated pump line lengths shall be tested by Contractor to verify suitability for Project before use at site.

2.7 REINFORCING FABRICATION

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice." Fabricate bars to required lengths, shapes, and bends. Do not rebend or straighten reinforcement in manner that could weaken material.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Examine conditions under which concrete shall be placed. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 FORMWORK INSTALLATION

- A. General: Design, erect, shore, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347 and ACI 117.

- B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, sleeves, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent concrete mortar leakage.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, etc., for easy removal.
- D. Erect forms in logical sequence to allow placement and inspection of reinforcement and other embedded items.
- E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for concrete placement. Securely brace temporary openings, and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- F. Provide cleanout panels at bottoms of deep wall and column forms.
- G. Chamfer exposed corners and edges as indicated using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- H. Fit corners and joints with gaskets or tape to prevent leakage.
- I. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- J. Sleeves: Provide sleeves in concrete formwork for plumbing, electrical, and mechanical penetrations. Coordinate size and location of sleeves with Contractors and mechanical, electrical, and plumbing drawings.
 - 1. Accurately place and secure in forms.
 - 2. Coordinate sleeve locations with reinforcing bars.
 - 3. Penetrations shall not occur through footings, piers, columns, beams, joists, grade beams, or supported slabs unless shown in structural drawings.
- K. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing before placing concrete as required to prevent mortar leaks and maintain proper alignment.
- L. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form-facing materials are not acceptable. Apply new form-release

agent. When forms are reused for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use patch forms for exposed concrete surfaces unless approved by Architect.

- M. Clean and coat forms before erection. Do not coat forms in place.
- N. Place concrete plugs in exposed holes left by form-tie cones.

3.3 SHORES AND SUPPORTS

- A. General: Comply with ACI 347 for shoring and reshoring in multistory construction and as herein specified.
- B. Provide thermometers adjacent to formwork to record curing temperatures
- C. Design formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure.
- D. Formwork for beams, slabs, and other parts that support weight of concrete shall remain in place at least 7 days and until concrete has reached 75 percent of the 28-day design strength as indicated by field-cured cylinders. Shoring shall not be removed and no additional loads of any sort shall be permitted on the structure until it has reached its 28-day design strength or has been properly reshored. Forms shall be removed at risk of the Contractor, and no pointing or patching shall be done until Engineer has observed the concrete and permitted such work.
- E. Formwork not supporting 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 degrees F (10 degrees C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- F. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.4 STEEL REINFORCEMENT PLACEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
- B. Clean reinforcement of loose rust, mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, hangers, or concrete brick as required.

1. Wire-tie intersections as required to prevent displacement of reinforcement.
 2. Do not wet set reinforcing bars. Wet setting is not permitted.
- D. Place reinforcement to obtain at least minimum concrete coverages for protection of bars. Minimum required concrete cover is noted in drawings.
- E. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- F. Use of nails in forms and use of clay brick to support reinforcement is prohibited.
- G. Supports for pile cap reinforcement shall be placed on subgrade. Do not place supports on ends of piles. Ends of piles shall be free of supports, dirt, and debris to provide a full bearing surface for the concrete pile cap.
1. Pile cap reinforcement may be suspended from forms in lieu of supporting on subgrade.
- H. Lap bar splices as indicated. Stagger splices in adjacent bars. Wire-tie splices.
- I. At points where bars lap-splice, including distribution steel, provide wire-tied minimum lap of 30-bar diameters unless otherwise required.
- J. Coordinate placement of reinforcement with openings, including sleeves and other embedded items. Where one or more bars are interrupted, provide additional reinforcement at openings. Additional reinforcement is noted in drawings.
- K. Place concrete in manner to ensure alignment of elements remains unchanged.
- L. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.
- M. Galvanized Reinforcement: Repair cut and damaged zinc coatings with zinc repair coating according to ASTM A 780. Use galvanized steel wire ties to fasten galvanized steel reinforcement.
- M. Comply with manufacturer-recommended procedures for installing and anchoring of doweled reinforcement using chemical adhesives, including drilling and cleaning of holes and mixing and applying of adhesives.

3.5 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items including anchor rods, leveling plates, embedded plates, and angles required for other work attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

- B. Do not wet set embedded items. Accurately position, support, and secure embedded items against displacing by formwork, construction, or concrete placement operations.
 - 1. Provide No. 3 rebar ties at top and bottom of anchor rods to maintain position or other accepted method.
- C. Anchor rods and embedded structural supports incorrectly located or damaged after installation shall be field modified, including repair or replacement, by Contractor.
 - 1. Notify Engineer of defective work. Submit proposed field modifications to Engineer for review and acceptance prior to making corrections.
 - 2. Proposed field modifications shall include design details and calculations, signed and sealed by a licensed Professional Engineer hired by Contractor.
 - 3. Field modifications shall be tested in accordance with Section 051200. Perform pull-out tests and other appropriate tests on each repair.
 - 4. Cost of field modifications shall be borne entirely by Contractor at no additional cost to Owner. Contractor shall reimburse Owner for cost of additional testing required.

3.6 INSTALLATION OF NON-STRUCTURAL EMBEDDED ITEMS

- A. General: Notify other trades to permit installation of their work, including reglets, conduit, and piping and to coordinate requirements of this section. Cooperate with other trades in setting work as required.
- B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings on outer face of exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
- C. Install dovetail anchor slots in concrete structures as indicated in drawings.
- D. ACI 318, Section 20.7, and guidelines listed below apply to conduit and piping.
 - 1. Do not embed aluminum items unless coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.
 - 2. Other than those passing through concrete elements, do not embed items that are larger than one-third of thickness of concrete element in which they are embedded.
 - 3. Conduits and pipes, with their fittings, embedded within a column shall not displace more than 4 percent of the cross section area of the column or that which is required for fire protection.
 - 4. Pipes and fittings embedded in concrete shall be designed to resist effects of the material, pressure, and temperature to which they will be subjected without transferring force to the surrounding concrete.
 - 5. No liquid, gas, or vapor, except water not exceeding 90° F nor 50 psi pressure, shall be placed in the pipes until the concrete has attained its design strength.
 - 6. Unless shown otherwise in structural drawings, install items as follows:
 - a. Space at least 12 inches apart and not less than three diameters or widths on center.
 - b. Place so they do not cross over each other within concrete elements.

- c. Place so they do not displace reinforcing bars from their proper location.
- d. Provide at least 3/4-inch concrete cover between items and reinforcing bars or concrete surfaces not exposed to weather or in contact with ground. Do not lay items on reinforcing bars. Provide at least 1½-inches concrete cover between items and concrete surfaces exposed to weather or earth.
- e. Securely position items by wire tying to support chairs or supports formed from reinforcing bars.
- f. Install sleeves at penetrations for nonstructural items passing through concrete elements.

3.7 PREPARATION OF FORM SURFACES

- A. General: Coat contact surfaces of forms with an accepted form-coating compound before placing reinforcement.
- B. Do not allow excess form-coating material to accumulate in forms or to come in contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- C. Coat steel forms with a nonstaining, rust-preventive material. Rust-stained steel formwork is not acceptable.

3.8 CONSTRUCTION JOINTS

- A. Construct joints true to line with faces perpendicular to surface plane of concrete. Locate and install construction joints so strength and appearance of concrete are not impaired, at locations indicated or acceptable to Architect.
 - 1. Provide keyways at least 1-1/2 inches deep in construction joints in walls. Roughen joints between reinforced concrete walls and footings to a minimum 1/4-inch amplitude and remove dirt and concrete laitance prior to casting concrete walls.
 - 2. Space vertical joints in walls as indicated in drawings. If not indicated, space joints a maximum of 60 feet and locate beside piers integral with walls, near corners, and in concealed locations where possible.
 - 3. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated. Do not continue reinforcement through sides of strip placements.
 - 4. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 5. Provide water stops in construction joints below grade and where indicated. Install water stops to form continuous diaphragm in each joint. Make provisions to support and protect exposed water stops during progress of work. Field-fabricate joints in water stops in accordance with manufacturer's printed instructions.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement and embedded items is complete and required inspections have been performed.

1. Notify other trades to permit installation of their work. Cooperate with other trades in setting work as required.
- B. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete" and as specified.
- C. Deposit concrete within 1-1/2 hour after water is added to dry batching, or use retarding admixture if accepted by the registered design professional responsible for structural engineering.
 1. For footings, foundation walls, and miscellaneous concrete only: A maximum of 2 1/2 gallons for each cubic yard of total mix design water can be added in field. Water must be added prior to discharging and testing concrete. At no time shall total water exceed amount listed in accepted mix design.
 2. For columns, beams, and slabs: Do not add water to concrete at job site without written consent of the Registered Design Professional responsible for Structural Engineering. Superplasticizer may be utilized, in approved quantities, to bring concrete to the required slump at the jobsite. Additions must be made prior to discharging and testing concrete.
- D. Deposit concrete continuously in one layer or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within section. Provide construction joints if section cannot be placed continuously.
- E. Deposit concrete as nearly as practicable to its final location to avoid segregation caused by rehandling or flowing.
- F. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in manner to avoid inclined construction joints.
- G. Keep excavations free of water. Do not deposit concrete in water, mud, snow, or on frozen ground.
- H. Maximum drop of concrete shall not exceed 5 feet. Use hopper and trunk for greater drops.
- I. Maintain reinforcing in proper position during concrete placement.
- J. Contractor shall be responsible for controlling the proper placing of embedded pipe, conduit, and other embedded items. See section "Installation of Non-Structural Embedded Items" for additional information.
- K. Pumping concrete is permitted only if mix designs specifically prepared and used previously for pumping are submitted. Pump line shall have 5-inch-minimum inside diameter and be used with 5-inch pumps.

3.10 CONSOLIDATION

- A. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
- B. Do not use vibrators to transport concrete inside formwork.
- C. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Vibrators shall penetrate placed layer of concrete at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set.
- D. 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.
- E. Do not allow vibrator to come in contact with form.
- F. Consolidation is typically not required for self-consolidating concrete mixes. However, provide internal vibration as required to prevent cold joints between pour lifts.

3.11 SURFACE FINISHES

- A. See drawings for required formed concrete surface finish where applicable. Special requirements for materials and workmanship may be required. Acceptability of finish surface with respect to surface void ratio, color uniformity, surface irregularities, and construction and facing joint shall be in accordance with ACI 347.3R-13. The following categories are applicable:

Formed Concrete Surface Category	Description†
CSC 1	Concrete surfaces in areas with low visibility or of limited importance with regard to formed concrete surface requirements, used or covered with subsequent finish materials.
CSC 2	Concrete surfaces where visual appearance is of moderate importance.
CSC 3	Concrete surfaces that are in public view or where appearance is important, such as exterior or interior exposed building elements.
CSC 4	Concrete surfaces where the exposed concrete is a prominent feature of the completed structure or visual appearance is important.

†ACI 347.3R-13 Table 3.1a

- B. Rough-Form Finish: Provide as-cast, rough-form finish to formed concrete surfaces that shall be concealed in finished work or by other construction. Standard rough-form finish is concrete surface having texture imparted by form-facing material used, with tie holes and other defective areas repaired and patched, and fins or other projections exceeding 1/4 inch in height rubbed down or chipped off.

- C. Smooth-Form Finish: Provide smooth-form finish for formed concrete surfaces that shall be exposed to view or covered with material applied directly to concrete such as waterproofing, dampproofing, veneer plaster, painting, or other similar systems. Produce smooth-form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.
- D. Smooth-Rubbed Finish: Provide smooth-rubbed finish to scheduled smooth-form finished concrete surfaces not later than one day after form removal.
 - 1. Moisten smooth-form finished concrete surfaces, and rub with carborundum brick or other abrasive until uniform color and texture are produced.
 - 2. Do not apply cement grout other than that created by the rubbing process.
- E. Grout-cleaned Finish: Provide grout-cleaned finish to scheduled smooth-form finished concrete surfaces.
 - 1. Combine 1 part portland cement to 1 1/2 parts fine sand by volume and a 1:1 mixture of acrylic or styrene butadiene-based bonding admixture and water to consistency of thick paint. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that final color of dry grout shall match adjacent surfaces.
 - 2. Thoroughly wet smooth-form finished concrete surfaces. Apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- F. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.
- G. Slab Float Finish: Apply power-float finish to slab surfaces that will subsequently be trowel-finished or covered with waterproofing membrane. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Using float blade or float shoes only, begin floating when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check surface plane to overall tolerance of F_F 18 and minimum local tolerance of F_F 13. Cut down high spots, and fill low spots. Uniformly slope surface to drains. Immediately after leveling, refloat surface to uniform, smooth, granular texture.
- E. Slab Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with other thin-film finish-coating system. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation. Surface shall be free of trowel marks, uniform in texture and appearance, and leveled to overall tolerance of F_F 35 and minimum local tolerance of F_F 25 for exposed slabs and other finishes. Grind smooth surface defects

that would telegraph through applied floor-covering system. Exposed surfaces are to be overtrowelled to "burn" surface to dense, hard, dark finish.

1. Where test sample area includes multiple floor finishes, more stringent tolerances shall apply to entire test sample area.
- F. Slab Broomed finish (at all ramps and walk surfaces): The surface shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface. This operation shall follow immediately after floating. Texture shall be as approved by the Architect from sample panels.
- G. Do not use dry materials, such as sand and cement, on surfaces during finishing. Do not sprinkle water on plastic surface. Do not disturb slab surfaces before beginning final finishing operations.

3.12 CONCRETE PROTECTING AND CURING

- A. Protect freshly placed concrete from premature drying, excessive hot or cold temperature, and damage in accordance with provisions of ACI 306R for cold-weather protection and ACI 305, for hot-weather protection.
- B. Curing Methods: Perform concrete curing in accordance with ACI 308 by wet-curing or moisture-retaining cover curing or combinations thereof as specified.
- C. Provide wet-curing by following methods:
 1. Keep concrete surface continuously wet by covering with water.
 2. Use continuous water-fog spray.
 3. 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 4-inch lap over adjacent absorptive covers.
- D. Provide moisture-retaining-cover curing as follows:
 1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair holes or tears during curing period using cover material and waterproof tape.
- E. Curing Vertical-Formed Surfaces:
 1. Keep forms in place for minimum of 7 days, 14 days in cold weather or until concrete has achieved 70 percent of its design strength.
 2. If forms are removed before minimum time period, alternate methods of curing, wet-curing, moisture-retaining-cover curing, or liquid-membrane curing, are required.
 - a. Contractor shall submit procedures to Architect for review.
 - b. Forms shall remain in place for a minimum of 24 hours when alternating methods of curing are used. For placement during cold weather, the

minimum time to form removal shall be extended based on expected weather conditions and Contractor's submitted procedures.

- F. Cure concrete placed under cold-weather conditions completely covering exposed surface of concrete with moisture-retaining cover completely sealed around edges. Cure concrete 14 days minimum with concrete temperature at or above 40 degrees F or 7 days minimum with concrete temperature at or above 70 degrees F.
- G. During hot weather after concrete has hardened, loosen form ties, keeping forms in place, and apply water to inside face of form to keep concrete continuously moist.

3.13 COLD-WEATHER CONCRETING

- A. Place concrete in accordance with ACI 306R.
- B. For cold-weather concreting (defined as when air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C) during the protection period), maintain concrete temperature in accordance with Table 5.1, and maintain concrete protection in accordance with Table 7.1 in "Cold-Weather Concreting" reported by ACI Committee 306.
- C. When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain concrete mixture temperature recommended in Table 5.1 of ACI 306R.
 - 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators.

3.14 HOT-WEATHER CONCRETING

- A. Place concrete in accordance with ACI 305.
- B. Cool ingredients before mixing to maintain concrete temperature below 85 degrees F at time of placement.
- C. 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.
- D. Cover reinforcing steel with water-soaked burlap if temperature of reinforcing steel exceeds ambient air temperature.
- E. Wet forms thoroughly before placing concrete.
- F. Fog-spray forms and reinforcing steel just before placing concrete.
- G. Use water-reducing, retarding admixture when required by high temperature, low humidity, or other adverse placing conditions when acceptable to Architect.

3.15 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after form removal when acceptable to Architect.
 - 1. Cut out honeycombs, rock pockets, voids over 1/2 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but not to a depth of less than 1 inch. Make edges of cuts perpendicular to concrete surface. Thoroughly clean, dampen with water, and brush-coat area to be patched with bonding agent. Place patching mortar before bonding compound has dried.
 - 2. For exposed-to-view surfaces, blend white portland cement and standard portland cement so patching mortar will match surrounding color when dry. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
- B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. These include surface defects such as color, texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form-tie holes, and fill with dry-pack mortar or precast-cement cone plugs secured in place with bonding agent.
 - 1. Where possible, repair concealed formed surfaces containing defects affecting concrete durability. If defects cannot be repaired, remove and replace concrete.
- C. Repair of Unformed Surfaces: Test unformed surfaces for smoothness, and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using template having required slope.
 - 1. Repair finished unformed surfaces containing defects affecting concrete durability. These include surface defects such as crazing, cracks, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
- D. Repair methods not specified above may be used subject to acceptance of Architect.

3.16 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades unless otherwise shown or directed after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling required to complete work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown in drawings. Coordinate sizes and locations with equipment supplied. Prior to placing concrete, set anchorage devices for machines and equipment using setting drawings, templates, diagrams, instructions and directions furnished with the equipment.
- D. Steel-Pan Stairs: Provide concrete fill for steel-pan stair treads, landings, and associated items. Cast-in safety inserts and accessories as shown in drawings. Screed, tamp, and finish concrete surfaces as scheduled.

3.17 TOLERANCES

A. Concrete Section/Placement/Formwork

- 1. Dimensions of Beams, Columns, Walls, Footings, Pile Caps
 - a. 12 inches or less: + 3/8 inch or - 1/4 inch
 - b. 12 inches to 36 inches: + 1/2 inch or - 3/8 inch
 - c. thicker than 36 inches: + 1 inch or - 3/4 inch
- 2. Dimension of Footing and Pile Cap in plan: +2 inch or -1/2 inch.
- 3. Thickness of walls and elevated slab: + 1/2 inch or - 1/4 inch
- 4. Deviation from elevation of top surface from lines parallel to specified grade lines:
 - a. of formed slabs before removal of supporting shores: +/- 1/2 inch.
 - b. of other formed surfaces before removal of shores: +/- 1/2 inch.
 - c. of bearing surface from specified elevation: +/- 1/2 inch.
 - d. Not to exceed 1/4 inch for adjacent members less than 20 feet apart or any wall length less than 20 feet; 1/2 inch for adjacent members 20 feet or more apart or any wall length of 20 feet and greater.
- 5. Distance between adjacent elements sectioned by a vertical plane:
 - a. where specified 2 inches or less: +/- 1/8 inch
 - b. where specified 2 inches < x < 12 inches: +/- 1/4 inch
 - c. all other elements: +/- 1 inch
- 6. Horizontal deviation from location (center) specified in plan from straight lines parallel to specified linear building lines:
 - a. +/- 1/4 inch for adjacent members less than 20 feet apart or any wall length less than 20 feet; 1/2 inch for adjacent members 20 feet or more apart or any wall length of 20 feet and greater.
 - b. other elements: +/- 1 inch
 - c. edge location of all openings: +/- 1 inch
- 7. Deviation from plumb: 1/4 inch for any 10 feet of height; 1 inch maximum for entire height.

B. Reinforcing

- 1. Vertical or horizontal variation from specified in plan
 - a. member depth 4 inch or less: +/- 1/4 inch

- b. member depth (or thickness) over 4 inch but not over 12 inch: $\pm 3/8$ inch
 - c. member depth (or thickness) over 12 inches: $\pm 1/2$ inch
 - 2. Spacing, measured long a line parallel to the specified spacing:
 - a. in slabs or walls: ± 3 inch
 - b. stirrups: lesser of ± 3 inches or ± 1 inch per foot of beam depth
 - c. ties: lesser of ± 3 inches or ± 1 inch per foot of least column widthIn all cases the total number of bars shall not be less than that specified.
 - 3. Longitudinal location of bends in bars and ends of bars:
 - a. at discontinuous ends of elements: ± 1 inch
 - b. at other locations: ± 2 inch
 - 4. Length of bar lap for #3 to #11: ± 1 inch
- C. Anchor Rods and Sleeves:
 - 1. Variation from specified location in plan: plus or minus $1/4$ inch.
 - 2. Variation from specified elevation: plus or minus $1/2$ inch.
- D. Embedded Items (plates, angles, etc.) other than anchor rods and sleeves:
 - 1. Variation from specified location in plan: plus or minus $1/4$ inch.
 - 2. Variation from specified elevation: plus or minus $1/4$ inch.

CONCRETE MIX DESIGN SUBMITTAL FORM

Submit separate form for each mix design

Project:	Location:
General Contractor:	Concrete Supplier:
Mix Design No:	Concrete Grade:
Use (Describe):	
Methods of Placement (chute, pump, chute and buggy, etc.):	
If placing by pumping, verify concrete mix can be pumped distances required in project:	

A. DESIGN MIX INFORMATION:

Based on Standard Deviation Analysis: _____ or Trial Mix Design Data: _____

Design Characteristics - Density: _____ pcf; Strength: _____ psi (28-day);

Slump: _____ in. required BEFORE adding superplasticizer (if used)

Slump: _____ in. required AFTER adding superplasticizer (if used)

Entrained Air Content: _____ % specified

Materials:

Aggregates: (size; type; source; gradation; specification)

Coarse: _____

Fine: _____

<u>Other Materials:</u>	<u>Type</u>	<u>Product-Manufacturer (Source)</u>
Cement:	_____	_____
Fly Ash:	_____	_____
Slag:	_____	_____

Admixtures:

Water Reducer: _____

Air-Entraining Agent: _____

High-Range, Water-Reducing Admixtures (superplasticizer): _____

Non-Corrosive Accelerator: _____

Other: _____

B. FINAL MIX DESIGN DATA:

RATIOS

Water _____ lb
Cementitious _____ lb = _____
Materials

Course Agg. _____ lb
Fine Agg. _____ lb = _____

SPECIFIC GRAVITIES

Fine Agg. _____

Coarse Agg. _____

Other: _____

ADMIXTURES

W.R.: _____ oz. per 100 # Cement

HRWR: _____ oz. per 100 #Cement

Non-Corrosive Accelerator: _____ oz.
Per 100# Cement

A.E.A.: _____ oz. per 100 # Cement

Other: _____ oz. per 100# Cement

PLASTIC CONCRETE

Initial Slump = _____ in.

Final Slump = _____ in.

MIX PROPORTIONS

WEIGHT ABSOLUTE
VOL. (LBS.)
(CU. FT.)

Cement: _____

Fly Ash: _____

Slag: _____

Fine
Aggregate: _____

Coarse
Aggregate: _____

Water: _____

Entrained

Unit Wet Wt. = _____ pcf

STANDARD DEVIATION ANALYSIS (from experience records):

Number of Test Cylinders Evaluated: _____ Standard Deviation: _____

$f_{cr} = f_c + 1.34s$ or $f_{cr} = f_c + 2.33s - 500$

(Refer to ACI for increased deviation factor when fewer than 30 tests are available.)

Mix # _____ Job Name _____

C. LABORATORY TEST DATA (HARDENED CONCRETE):

COMPRESSIVE STRENGTH

Age (days)	Mix #1	Mix #2	Mix #3
7	_____	_____	_____
14	_____	_____	_____
28	_____	_____	_____
Other	_____	_____	_____

28-day average compressive strength: _____ psi

Mix design proportioned to achieve $f_{cr} = f_c + 1200$ psi (1400 psi for strength higher than 5000 psi at 28 days)

CHLORIDE ION CONTENT:

Remarks: _____

NOTE: Fill in all blank spaces. Use-0- (Zero) or N.A. (Not Applicable) where appropriate. See "Design and Control of Concrete Mixtures," 13th Edition by Portland Cement Association, for assistance in completing this form.

D. REQUIRED ATTACHMENTS:

- _____ Coarse aggregate gradation report and DOT certification
- _____ Fine aggregate gradation report and DOT certification
- _____ Concrete compressive strength data used for standard deviation calculations
- _____ Chloride ion data and related calculations
- _____ Rapid chloride permeability test report
- _____ Admixture compatibility certification letter

Submitted by Ready-Mix Supplier:

Name _____

Address _____

Phone Number _____ Date _____

Main Plant Location _____ Miles from Project _____

Secondary Plant Location _____ Miles from Project _____

END OF SECTION 03 3000

SECTION 03 3020 - CONCRETE SLABS ON GRADE AND METAL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including general and supplementary conditions and Division 1 specification sections, apply to this section.
- B. Section 03 3000: Cast-In-Place Concrete.

1.2 DESCRIPTION OF WORK

- A. This section supplements Section 033000: Cast-In-Place Concrete, with specific emphasis on concrete slabs supported on grade and metal deck. The general requirements of Section 033000 pertain to this section unless otherwise specified in this section.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. ACI 302 "Guide for Concrete Floor and Slab Construction."
- B. Hold a slab preconstruction meeting at least 14 days prior to initial planned date of slab placement. Discussion shall include subbase preparation, reinforcing and dowel placement, slab joints, concrete mix designs, and procedures for concrete placement, finishing, curing, and protection. Attendees shall include Contractor, Placement Subcontractor, Concrete Supplier, Special Inspector, Testing Agency, Engineer, and Architect.
 - 1. If embedments such as conduit and pipe are to be embedded in slabs on metal deck, the installing Contractor shall also attend the slab preconstruction meeting.
- C. Provide protection from precipitation for vapor retarder and slab subbase prior to slab-on-grade placement. Provide protection for slab on grade from direct exposure to sun, wind, precipitation, and excessive cold or hot temperatures starting during placement and lasting until end of curing period.
 - 1. After curing period, provide protection from precipitation for slab-on-grade openings (column blockouts, mechanical blockouts, expansion/isolation joints, etc.) to prevent moisture from entering slab subbase.
 - 2. Contractor shall be responsible for cost of repairing slab defects resulting from deficient protection methods.
 - 3. One method of protection is installing roof membrane and roof drains prior to installing vapor retarder, slab subbase, and slab on grade.

1.4 SPECIAL INSPECTIONS

A. Refer to Specification Section 014533 and Schedule of Special Inspections.

1.5 MATERIAL EVALUATION/QUALITY CONTROL

- A. Contractor shall secure services of company field advisor from manufacturer of water vapor-reducing admixtures (WVRA) and concrete surface treatment products, including sealers, hardeners, sealants, and finishes. Field advisor shall be certified in writing by manufacturer to be technically qualified in product installation. Personnel involved solely in sales do not qualify. Field advisor shall be present at beginning of installation of product and as required during duration of project for the purpose of:
1. Render technical assistance to Contractor regarding installation procedures of product to satisfy warrantee or guarantee requirements.
 2. Provide specialized training in use of product to Contractor's personnel.
 3. Verify surface preparation procedures and suitable substrates for material application.
 4. Verify proper mixing proportions and procedures for product.
 5. Verify proper temperature and other environmental controls.
 6. Verify proper tools and application procedures.
 7. Verify proper curing and protection of installed product.
 8. Familiarize Contractor/Owner/Architect/Engineer with entire system, including inspection techniques.
 9. Answer questions that arise.
- B. Field advisor shall prepare a written report summarizing information listed above. Submit report to Special Inspector, Contractor, Owner, Architect, and Engineer.
- C. Contractor shall be responsible for expenses of field advisor and verifying credentials of advisor.
- D. Contractor shall be responsible for the cost of any special procedures required by the manufacturer of WVRA to allow for the placement of slab finishes in advance of the specified minimum time period.
- E. WVRA manufacturer's warranty shall include:
1. Term: Minimum of 10 years.
 2. Repair and/or removal of failed flooring.
 3. Placement of topical moisture remediation system.
 4. Replacement of flooring materials equal to quality of original installation including material and labor.

1.6 SUBMITTALS

- A. Comply with Section 03 3000.
- B. Submit option for slab placement (see Part 3 of this section) and layout of slab joints.

- C. Prior to slab placement, submit to Special Inspector and Engineer for information only a written protection program for vapor retarder, slab subbase, slab on grade, and slab on metal deck.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT AND ACCESSORIES

- A. Reinforcement: ASTM A 615, Grade 60 for uncoated deformed bars.
 - 1. ASTM A 775 for epoxy-coated, deformed bars.
 - 2. ASTM A 767 Class I for galvanized deformed bars.
 - 3. ASTM A 955 for stainless steel deformed bars.
 - 4. Coatings (epoxy or zinc) applied after fabrication and bending.
- B. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.
- C. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- D. Supports for Reinforcement: Use wire bar-type supports complying with CRSI specifications. For slabs on grade, use chairs with sand plates or horizontal runners where base material will not support chair legs.
 - 1. Concrete bricks may be used to support reinforcing for slabs on grade. Stagger brick locations.
 - a. Do not use clay bricks.
 - b. Do not use bricks to support epoxy-coated or galvanized reinforcing.
 - c. Do not use bricks to support reinforcing for slabs on metal deck.
 - 2. Supports for epoxy-coated reinforcing shall be either wire bar-type coated with epoxy, plastic, or vinyl compatible with concrete for minimum distance of 2 inches from point of contact with reinforcing or all plastic-type.
 - 3. Supports for galvanized reinforcing shall be either galvanized wire bar-type or all plastic-type.
 - 4. Finish (epoxy-coated or galvanized) for supports formed from reinforcing bars shall match finish of supported reinforcing.
- E. Minimum 16-gauge annealed tie wire, ASTM A 82.
- F. Deformed-Steel Wire: ASTM A 496/A 496M.
- G. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, plain steel wire, with less than 2 percent damaged coating in each 12-inch wire length.
 - 1. Provide coated wire ties for use with epoxy-coated or galvanized bars. Acceptable coatings include epoxy, nylon, or vinyl. Galvanized wire ties may be used with galvanized bars. Do not use plain wire ties.

H. Dowel Bars for Slabs on Grade:

1. Construction Joints.
 - a. 1-inch-square steel bars with 1/4-inch-compressible foam on vertical faces.
 - b. 3/8-inch by 4.5-inch-square "Diamond Dowel" plate and sleeve by PNA Construction Technologies or accepted equivalent.
2. Contraction Joints.
 - a. 3/8-inch by 2-inch by 8-inch-long alternating tapered plate dowels "PD3 Basket Assembly" by PNA Construction Technologies or accepted equivalent.

2.2 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150. Type II or Type I/II only.
- B. Fly Ash: ASTM C 618, Type F, with loss on ignition of less than 6 percent.
- C. Ground-Granulated, Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- D. Water: ASTM C 94, clean, fresh, drinkable.
- E. Aggregates: NYSDOT-approved, Section 703-02 (normal weight), one source and as herein specified.
 1. Fine Aggregate: Coarse, clean, sharp, uniformly graded natural sand free of loam, clay, lumps or other deleterious substances. Less than 10 percent passing No. 100 sieve and less than 3 percent passing No. 200 sieve.
 2. Coarse Aggregate for Slabs on Grade: Uniformly graded to 1 1/2 inches, clean, processed, crushed stone with low absorption and free of flat/elongated particles. NYSDOT-approved, size 3A gravel can be used to meet large diameter requirement. Gradation similar to blended NYSDOT Type CA 2 and size 1A or ASTM C 33 Type 57 and Type 8, blended and modified as follows:

Sieve Size	Percent Passing
1 inch	95 to 98.5
3/4 inch	75 to 94
1/2 inch	25 to 50
3/8 inch	10 to 25
No. 4	0 to 10

3. Coarse Aggregate for Slabs on Metal Deck: Uniformly graded to 1 1/2-inches, clean, processed, crushed stone obtained from quarried bedrock with low absorption and free of flat/elongated particles. NYSDOT-approved, size 3A gravel can be used to meet large diameter requirement. Gradation similar to blended NYSDOT Type CA 2 and size 1A or ASTM C 33 Type 57 and Type 8, blended and modified as follows:

Sieve Size	Percent
------------	---------

	Passing
1 inch	95 to 100
3/4 inch	82 to 94
1/2 inch	40 to 68
3/8 inch	20 to 44
No. 4	0 to 10

4. Lightweight Coarse Aggregate for Slabs on Metal Deck: ASTM C 330, Size 3/4-inch to No. 4. Dry unit weight of concrete shall be a maximum 120 pcf from a batch weight of 120 to 124 pcf, presoaked to achieve a damp condition according to ACI 211.2; limit shrinkage to 0.03 percent at 28 days.

2.3 ADMIXTURES

- A. Air Entraining: ASTM C 260.
- B. Set-Control Admixtures: Not permitted.
- C. Calcium Chloride: Not permitted.
- D. Water-Reducing Admixture: "Eucon WR-75" or "Eucon WR-91" by Euclid Chemical Co.; "MasterPozzolith 200" by Master Builders; or "Plastocrete 161" by Sika Chemical Corp. Admixture shall conform to ASTM C 494, Type A, and not contain more chloride ions than in municipal drinking water.
- E. Mid to High Range Water Reducer/Finish Enhancer: "MasterPolyheed 997" by Master Builders; "Sikament 686" by Sika Chemical Corp; or accepted equivalent. Admixture shall conform to ASTM C 494 Type A and F and not contain more chloride ions than in municipal drinking water.
- F. Integral Water Vapor-Reducing Admixture (WVRA): Sodium silicate admixtures by "Vapor Lock 20/20" by Specialty Products Group (SPG); "Barrier One" by Barrier One, Inc.; "Moxie 1800 Super-Admix" by Moxie International; with the following minimum performance:
 - 1. Water Vapor Transmission: Maximum 0.03 US perms per ASTM E 96.
 - 2. Water Proofing: Maximum 1.0×10^{-8} cm/s per ASTM D-5084.

2.4 RELATED MATERIALS

- A. Premolded Joint Filler for Slabs on Grade: Provide resilient and nonextruding, premolded, bituminous fiberboard units complying with ASTM D 1751; 1/2-inch-thick, full slab depth.
- B. Construction Joint Form: Square edge form only. Keyed joint not permitted.
- C. Semi-Rigid Epoxy Joint Filler for Interior Exposed Slabs: At exposed slabs, seal joints with "Sikadur 51SL" by Sika; "Sure Fil J52" by Dayton Superior; "MM-80P" by Metzger/McGuire; "Euco 700" by Euclid Chemical Co.

- D. Semi-Rigid Polyurea Joint Filler for Interior Slabs: At interior slabs to receive broadloom carpet, hardwood, or VCT, seal joints with "Euco QWIKjoint 200" by Euclid Chemical Co.; "Spal-Pro RS 65" by Metzger/McGuire; "Sika Loadflex" by Sika; or accepted equivalent.
- E. Cementitious Joint Filler for Interior Slabs (Self-Leveling Topping): At interior slabs to receive rubber-backed carpet, solid vinyl tile, and for all other floor coverings, seal joints with "Ardex K301" by Ardex; "Fast Setting Floor Resurfacer" by Quikrete; "Level-X52" by Edison Coatings; "SLT-HS" by Raeco; or accepted equivalent.
- F. Polyurethane Joint Sealant for Exterior Slabs: "Sikaflex-2c SL" by Sika; "MasterSeal SL2" by Master Builders; "Eucolastic 2 SL" by Euclid Chemical Co.; "Urexpan NR-200" by Pecora Corporation; or accepted equivalent.
- G. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 ounces a square yard and complying with AASHTO M 182, Class 2.
- H. Curing-Sheet Materials: ASTM C 171; waterproof paper, polyethylene film, or polyethylene-coated burlap.
 - 1. For slabs exposed to view, provide one of the following or accepted equivalent:
 - a. "HydraCure S16" by PNA Construction Technologies.
 - b. "UltraCure NCF/SUN" by McTech Group.
- I. Penetrating Exterior Anti-Spalling Sealer: "Euco-Guard 100" by Euclid Chemical Co. (mixed to 17.5 percent concentration); "MasterProtect H400" by Master Builders; "Aquapel Plus" by L&M Construction Chemicals; or accepted equivalent.
- J. Evaporation Retarder: Monomolecular, film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss. "Aquafilm J74RTU" by Dayton Superior; "Eucobar" by Euclid Chemical Co.; "MasterKure ER 50" by Master Builders, Inc.; or accepted equivalent.
- K. Crack Repair Material: For cracks smaller than 1/8-inch, use "Sika Pronto 19" methacrylate by Sika; "Rapid Refloor" polyurea by Metzger McGuire; or accepted equivalent. For cracks greater than 1/8-inch, use specified joint filler material.
- L. Hardener: "MasterKure HD 300WB" by Master Builders, Inc.; or accepted equivalent for exposed slabs.
- K. Vapor Retarder: Provide vapor retarder cover over prepared subbase where indicated below slabs on grade. Use only materials that are resistant to deterioration when tested in accordance with ASTM E 154 as follows:
 - 1. Polyolefin not less than 15 mils thick, in compliance with ASTM E 1745 Class A and with a perm rating less than 0.02 perms. "Stegowrap 15 mil Class A" by Stego Industries LLC; "Moistop Ultra 15" by Fortifiber Building Products; "Griffolyn 15 Mil Green" by Reef Industries, Inc.; or "Vapor Block 15" by Raven Industries.
 - 2. Provide manufacturer's-recommended, pressure-sensitive/water-resistant seam tape and mastic for vapor retarder selected.

2.5 PROPORTIONING AND MIX DESIGN

A. Concrete Quality:

Location	Required 28-Day Compressive Strength (psi)	Approximate Cementitious Materials Content (pounds)	Maximum Water/Cement Ratio	Percent Entrained Air
Interior slabs on grade	See drawings	530	See drawings (265 pounds maximum total water)	See drawings *
Normal Weight interior slabs on metal deck	See drawings	530	See drawings (265 pounds maximum total water)	See drawings *
Lightweight interior slabs on metal deck	See drawings	611	See drawings (300 pounds maximum total water)	See drawings ***
Normal weight exterior slabs on grade (subject to deicing chemicals)	See drawings	658****	See drawings	See drawings **
Normal weight exterior slabs on grade or metal deck (not subject to deicing chemicals)	See drawings	658****	See drawings	See drawings **

* Do not add air-entraining admixtures. Air entrapment occurs as result of mixing.

** Plus or minus 1.5 percent.

*** Air-entrainment admixtures may be added to lightweight concrete that is pumped. Entrained air content shall not exceed 4 percent.

**** Maximum cement content 563 pounds plus 20 percent pozzolans by weight. Minimum cement content 488 pounds plus 20 percent pozzolans by weight.

B. Slump: 5-inch maximum for normal and mid-range, water-reduced mixes.

C. Concrete containing a high-range, water-reducing admixture (superplasticizer) shall have maximum slump of 6 inches unless otherwise accepted by Engineer.

D. Use 564 pounds (6 sacks) maximum of cement for each cubic yard for interior slabs and minimum sand content.

E. For normal-weight concrete, quantity of coarse aggregate in pounds must be in range of

- 1.25 to 1.5 times quantity of fine aggregate in pounds. Provide minimum of 1,800 pounds of coarse aggregate for each cubic yard of concrete.
- F. For lightweight concrete, provide minimum 675 pounds of lightweight coarse aggregate (saturated, surface dry) for each cubic yard of concrete.
- G. Pozzolans:
1. Pozzolans may be substituted for cement in normal-weight concrete for interior slabs, including fly ash at a maximum rate of 20 percent by weight or ground-granulated, blast-furnace slag at a maximum rate of 35 percent by weight.
 2. Pozzolans shall be used at a rate of 20 percent by weight of total cementitious materials for exterior slabs.
 3. LEED: Pozzolans substitution for cement in normal-weight concrete shall be documented as required by Section 03 3000.
 4. Submittals shall include actual mix design, including percentage of pozzolans and test results showing mix meets specified 7-day compressive strength where indicated, 28-day compressive strength, and air content.
 5. Protect and heat concrete containing pozzolans during cold-weather conditions. Maintain protection and heat until 70 percent of specified design strength is achieved.
- G. Pumping concrete is permitted only if mix designs specifically prepared and used previously for pumping are submitted. Mix designs not previously used for anticipated pump line lengths shall be tested by Contractor to verify suitability for project before use at site. Pump line shall have 5-inch-minimum inside diameter and be used with 5-inch pumps.
- H. Provide WVRA for interior slabs where indicated in the Drawings.
1. Where not indicated in the Drawings, Contractor has the option to use WVRA for interior slabs. Contractor shall coordinate with floor installer to provide appropriate floor adhesive for attachment to slabs containing WVRA, and shall review the proposed adhesive materials with the Architect. The optional use of WVRA and compatible floor adhesive shall not incur additional cost to the Owner.
 2. Comply with Manufacturer's recommended dosage rates and procedures.

PART 3 - EXECUTION

3.1 GENERAL

- A. Examine conditions under which work shall be performed. Do not proceed with work until unsatisfactory conditions are corrected.
- B. Whenever possible, air temperature should be rising after concrete placement. Attempt to schedule slab placements according to favorable weather reports.

3.2 OPTION FOR SLAB PLACEMENT

- A. For placement of slabs that will be exposed in final structure, place construction and contraction joints as shown in drawings or as recommended by ACI 302 if not shown.
- B. For placement of slabs that will be subsequently concealed with an architectural finish material, Contractor has two options. Option 1 is to place slabs with few joints or construction joints only. Option 2 is to place slabs with construction and contraction joint spacings as recommended by ACI 302, "Guide for Concrete Floor and Slab Construction." Contractor shall submit option to be used and joint layout to Architect and Engineer for review.
- C. If Option 1 is selected, shrinkage cracking will likely occur but potential for curling will be reduced. Contractor shall be responsible for repairing cracks and curled areas. If Option 2 is selected, probability of shrinkage cracking will be less but probability of curling will increase. Contractor shall be responsible for repairing cracks and curled areas.

3.3 PRECONCRETE PLACEMENT

- A. Just before concrete placement on grade, slab subbase shall be dry.
- B. Whenever possible, air temperature should be rising after concrete placement. Attempt to schedule slab placements according to favorable weather reports.
- C. Subgrade shall be frost-free.

3.4 EDGE FORMS AND SCREED STRIPS FOR SLABS ON GRADE

- A. Set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surfaces. Provide secure edge forms or screed strips to support strike-off templates or compacting vibrating-type screeds. Wet screeding is not permitted.

3.5 VAPOR RETARDER INSTALLATION

- A. Following placement and compaction of subbase, place vapor retarder sheeting with longest dimension parallel with the direction of slab placement.
- B. Install vapor retarder in accordance with ASTM E 1643, manufacturer's instructions, and as follows:
 - 1. Lap joints 6 inches, and seal vapor retarder joints with manufacturer-recommended seam tape.
 - 2. Extend vapor retarder up walls and penetrations 4 inches minimum.
 - 3. Seal vapor retarder to walls and penetrations with manufacturer-recommended mastic to form continuous barrier.
 - 4. Repair damaged areas by cutting patches of vapor retarder material and placing to overlap damaged areas by 6 inches each side. Seal each side of patch with seam tape.
- C. Remove debris and standing water from vapor retarder prior to slab placement.

3.6 REINFORCEMENT PLACEMENT

- A. Place slab reinforcing one-third of slab thickness below top surface of slabs on grade and 1 inch below top surface of slabs on metal deck. Support reinforcement by metal chairs, runners, bolsters, or concrete brick (slabs on grade only) as required.
- B. Dedicate workers to placement of reinforcement to continuously monitor and adjust reinforcement location during concrete placement.
- C. Touch up damaged epoxy-coated reinforcement in field after placement with epoxy patching material provided by coating manufacturer.

3.7 INSTALLATION OF NON-STRUCTURAL EMBEDDED ITEMS

- A. General: Notify other trades to permit installation of their work and coordinate with requirements of this section. Cooperate with other trades in setting work as required.
- B. Do not embed aluminum items unless coated to prevent galvanic reaction with concrete and steel.
- C. Do not embed conduit or other nonstructural items that are larger than the lesser of the following unless otherwise detailed:
 - 1. One-inch diameter.
 - 2. One-third the thickness of concrete slab above metal deck.
- D. Avoid embedding conduit or other nonstructural items wherever possible. If unavoidable, limit size as noted above and install embedded item following the guidelines below.
 - 1. Space at least 18 inches apart.
 - 2. Place so nonstructural items do not cross each other.
 - 3. Provide at least 1-inch concrete cover between items and slab surface. Provide minimum 3/4-inch concrete cover between items and deck, screed angles, edge forms, or reinforcing bars. Do not lay items on deck or reinforcing bars. In exterior slabs, provide at least 1½-inches concrete cover between items and exposed surfaces.
 - 4. Provide at least 1-inch concrete cover between embedded items and shear connectors in composite beam construction.
 - 5. Securely position items by wire tying to support chairs.
- E. Items such as trench ducts and electrical floor boxes require special consideration. Known conditions are detailed in drawings. Notify Architect and Engineer of discrepancies or locations not detailed.
- F. Install PVC sleeves at plumbing penetrations. Do not core-drill unless accepted by Engineer. Cut deck after slab has cured 28 days or after slab reaches its design strength.

3.8 ISOLATION JOINTS

- A. Construct isolation joints in slabs at points of contact with vertical surface and elsewhere as indicated.
- B. Use two layers of polyethylene film as bond breaker for slabs on metal deck.

3.9 CONSTRUCTION JOINTS

- A. Locate and install construction joints not shown in drawings so as not to impair strength and appearance of structure as acceptable to Engineer.
- B. Construction joints in exposed slabs on grade shall be doweled joints.
- C. Continue half of bar reinforcement through construction joints in concealed slabs and slabs on metal deck.
 - 1. If Contractor chooses to cut reinforcement for slabs on grade after placement, protect the vapor retarder and use cutting method which will not result in damage to the vapor retarder. Thermal cutting of reinforcement after placement is not permitted.
 - 2. Contractor shall repair damage to vapor retarder prior to slab on grade placement.

3.10 CONTRACTION JOINTS

- A. Saw cut contraction joints as soon as possible after finishing, generally within 4 to 16 hours. Make sample cut to determine if concrete surface is firm enough so it is not torn or damaged by blade.
- B. Use soft-cut contraction joints.
 - 1. For slabs on grade, depth of cut shall be one-fifth of slab thickness with minimum of 1 inch.
 - 2. For slabs on metal deck, depth of cut shall be one-fifth of slab cover over metal deck, with maximum depth of $\frac{3}{4}$ inch.
- C. Obtain permission from Engineer if diamond blade cutting is to be used.
- D. Contraction joints in exposed slabs on grade shall be doweled joints.
- E. Continue half of bar reinforcement through contraction joints in concealed slabs and slabs on metal deck.
 - 1. If Contractor chooses to cut reinforcement for slabs on grade after placement, protect the vapor retarder and use cutting method which will not result in damage to the vapor retarder. Thermal cutting of reinforcement after placement is not permitted.
 - 2. Contractor shall repair damage to vapor retarder prior to slab placement.

3.11 DOWELED JOINTS FOR SLABS ON GRADE

- A. Install dowel bars parallel to slab surface and perpendicular to joints. Support dowel bars by use of parallel construction supports.
- B. Use square cushioned dowels or Diamond Dowel plates and sleeves in construction joints.
- C. See drawings for contraction joints.

3.12 PLACING CONCRETE SLABS

- A. Maximum of 2 1/2 gallons for each cubic yard of total mix design water can be added in field. Water must be added prior to discharging and testing concrete. At no time shall total water exceed amount listed in accepted mix design.
- B. Slabs on Grade:
 - 1. Use strip pour methods and mechanical vibratory screed whenever possible.
 - 2. Deposit and consolidate concrete in continuous operation within limits of construction joints until placing of panel or section is complete.
 - 3. Consolidate concrete during placing operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 4. Maximum placement width shall not exceed 20 feet for very-flat and super-flat slabs.
 - 5. Bring slab surfaces to correct level with a straightedge and strike off. Uniformly slope to drains. Use darbies to smooth surface, leaving it free of humps or hollows. Do not sprinkle water or portland cement on plastic surface. Do not disturb slab surfaces before beginning finishing operations.
 - 6. Maintain reinforcement in proper position during concrete placement operations. See requirements for reinforcement placement.
 - 7. Slab thicknesses shown in drawings are minimum allowable. Maximum allowable thickness shall be 1 inch greater than specified thickness.
 - 8. For floor areas with drains, Contractor shall be responsible for finishing concrete slabs to proper elevations to ensure surface moisture will drain freely to floor drains and no puddle areas exist. Reference elevations shown in drawings.
 - 9. Cost of corrections to provide for positive drainage shall be the responsibility of Contractor.
- C. Slabs on Metal Deck:
 - 1. Place concrete in direction opposite to direction metal deck sheets were placed.
 - 2. Deposit and consolidate concrete in continuous operation within limits of construction joints until placing of panel or section is completed.
 - 3. During placement, avoid overloading metal deck or supporting structural members.
 - 4. Consolidate concrete during placing operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 5. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, leaving it free of humps or hollows. Do not sprinkle water on plastic surface. Do not disturb slab surfaces before beginning finishing operations.
 - 6. Maintain reinforcement in proper position during concrete placement operations.

- See requirements for reinforcement placement.
7. For floor areas with drains, Contractor shall be responsible for finishing concrete slabs to proper elevations to ensure surface moisture will drain freely to floor drains and no puddle areas exist. Reference elevations shown in drawings.
 8. Cost of corrections to provide for positive drainage shall be responsibility of Contractor.
 9. Steel floor structure will deflect under weight of wet concrete. Placement of additional concrete may be required after initial wet screeding. Where indicated, camber will reduce but not eliminate need for placing additional concrete. Place varying-thickness concrete slab to maintain required finished-floor elevation. Placement sequence and joint locations are critical and shall be reviewed at slab preconstruction meeting.

3.13 SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to tolerances for floor flatness (F_F) of 15 and floor levelness (F_L) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes to produce a profile amplitude of $\frac{1}{4}$ inch in one direction.
- B. Float Finish: Apply power float finish to slab surfaces that will subsequently be trowel finished or covered with waterproofing membrane. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating using float blade or float shoes when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to overall tolerances of F_F 18 and F_L 13, and minimum local tolerances of F_F 13 and F_L 10. Cut down high spots and fill low spots. Uniformly slope surface to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin-film finish-coating system. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation. Surface shall be free of trowel marks, uniform in texture and appearance, and leveled to an overall tolerance of F_F 25 and F_L 20 and minimum local tolerance of F_F 17 and F_L 13 for carpet and ceramic or quarry tile finishes and overall tolerance of F_F 35 and F_L 25 and minimum local tolerance of F_F 25 and F_L 17 for exposed slabs and other finishes. Grind smooth surface defects that would telegraph through applied floor-covering system. Exposed surfaces are to be overtrowelled to "burn" surface to a dense, hard, dark finish.
 1. Where test sample area includes multiple floor finishes, more stringent tolerances shall apply to entire test sample area.

- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified and immediately follow with fine brooming to slightly scarify surface.
- E. Nonslip Broom Finish for Slabs on Grade: Apply nonslip, heavy broom finish to exterior concrete slab surfaces. Immediately after trowel finishing, roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- F. Delay finishing as long as possible. Allow bleed water to evaporate before finishing.
- G. Finish slabs to specified tolerances given. Patching low spots shall not be permitted. Perform grinding as soon as possible, preferably within 3 days, but not until concrete is sufficiently strong to prevent dislodging coarse aggregate particles.

3.13 COLD-WEATHER CONCRETING

- A. Comply with Section 03 3000.
- B. Provide temporary heat with vented heaters only.
- C. Use foggers to maintain humidity at 50 percent minimum.

3.14 HOT-WEATHER CONCRETING

- A. Comply with Section 03 3000.

3.15 CURING AND PROTECTION

- A. Protect freshly placed slabs from premature drying and excessive cold or hot temperature. Maintain without drying at a relatively constant temperature for time period necessary for cement hydration and proper hardening.
- B. Cure exterior slabs completely by moist-curing using burlap absorptive cover, soaker hoses, and ponding for at least 7 days. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers. Avoid rapid drying at end of curing period. Allow absorptive cover to remain an additional 3 days.
- C. Cure interior slabs by sheet-curing by covering slabs with curing sheet material for 7 days minimum. Avoiding rapid drying at end of curing period. Place curing cover in widest practicable width with sides and ends lapped at least 3 inches and sealed with waterproof tape or adhesive. Immediately repair holes or tears in cover during curing period.
- D. Do not allow foot or other traffic over slabs during 7-day curing period.
- E. Cure slabs or pads 14 days minimum before placing equipment.

F. Interior Nonexposed Slabs:

1. Place finish toppings, coatings, tile, and other materials to be bonded to slabs when the following have been satisfied:
 - a. Slabs have cured minimum of 90 days.
 - b. Acceptable moisture vapor emission and alkalinity test results have been achieved.
 - c. Acceptable 72-hour Bond Test results have been achieved. Bond test by floor finish installer.

G. Interior Exposed Slabs:

1. Apply two coats of hardener after slabs have cured 28 days minimum at rate of 100 square feet/gallon in accordance with manufacturer's recommendations.

H. Exterior Slabs:

1. Apply penetrating exterior anti-spalling sealer to exterior concrete slabs, walks, platforms, steps, ramps, and curbs according to manufacturer's directions.

3.16 JOINT SEALANT

- A. Install joint sealant in exposed construction, isolation, and contraction joints in accordance with manufacturer's recommendations.
- B. Clean joints thoroughly before applying sealant.
- C. Apply sealant after slabs have cured 90 days minimum.

3.17 REPAIR OF SURFACES

- A. Contractor shall be responsible for cost of repairing slab defects.
- B. Test surfaces for flatness and level tolerances. Test uniform surfaces sloped to drain for trueness of slope.
- C. Correct flatness and levelness defects by grinding or removing and replacing slab. Patching low spots not permitted. Repair areas shall be remeasured and accepted by Owner.
- D. Repair cracks only when slab is more than 90 days old. Use crack repair material. For cracks over 1/8-inch, fill crack with oven-dried sand prior to application of crack repair material as recommended by manufacturer. Contractor has option to remove and rebuild areas of cracking. Mask cracks to limit crack repair material to crack only.
- E. Repair curling only when slab is more than 90 days old.

- F. Curling at slab edges exceeding 1/8 inch when measured with a 10-foot straightedge shall be made level by grinding or planing. Locate straightedge with its end at the slab edge, and measure space between straightedge and slab.
- G. If curling exceeds 1/4-inch, level slab by grinding or planing as stated above. In addition, core-drill slab 10 inches from joint at 2-foot intervals, alternating on each side of joint, and inject nonshrink grout to fill void beneath slab.
- H. Repair edge spalls occurring from shrinkage cracking or from Contractor's operations with methods acceptable to Engineer.

END OF SECTION 03 3020

SECTION 03 3600 - POLISHED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Preparation of concrete flooring for application of liquid hardener/sealer.
 - 2. Application of liquid hardener/sealer.
 - 3. Polishing concrete to desired finish level.

1.2 SUBMITTALS

- A. Product Data: For each type of material and accessory indicated.
- B. Samples for Initial Selection: Manufacturer's color plates showing the full range of colors and patterns available.
- C. Qualification Data: For Installer.
- D. Maintenance Data: To include in maintenance manuals.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer shall be certified in writing by manufacturer of specified polished concrete system to install their products.
 - 2. Installer shall have 5 years experience, completed polished concrete installations similar in material, design, and extent to that indicated for this Project, and shall submit a record of successful in-service performance.
- B. Source Limitations for Products: Provide only those products approved and/or provided by manufacturer of polished concrete system as specified.
- C. Mockups: Install mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Execute polished concrete mockup in location directed by Architect, minimum 5' x 5' in size.
 - 2. Reprepare mock-up as required to obtain Architect's approval.
 - 3. Protect mock-up during execution of polished concrete flooring.
 - 4. Remove mock-up upon completion and acceptance of installed polished concrete flooring in building.

- D. Preinstallation Conference: Conduct conference at Project site with all affected parties.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number, if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's requirements and Division 03 "Cast-In-Place Concrete" section.
 - 1. Concrete shall be cured a minimum of 45 days prior to application of concrete polishing system.

1.6 WARRANTY

- A. Provide system manufacturer's 10-year product and labor warranty covering entire installed system.

PART 2 - PRODUCTS

2.1 LIQUID HARDENER/SEALER

- A. Densifier, Hardener and Sealer: Water-based sodium silicate "RetroPlate 99" manufactured by Advanced Floor Products, Inc.
 - 1. Provide Level 1 hard shell satin finish.
 - 2. Finish shall produce minimum 0.60 Static Coefficient of Friction as determined by testing identical products per ASTM C 1028.
 - 3. Material shall have zero VOC's.
- B. Dyes: Provided by Retroplate; color as selected by Architect.
- C. Grinding/Polishing Equipment: All machinery shall be approved for use by Advanced Floor Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION

- A. Clean and/or mechanically abrade or grind substrates in accordance with polished flooring material manufacturer's recommendations to produce clean, dry, and neutral substrate for system application.
 - 1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 INSTALLATION, GENERAL

- A. Comply with manufacturer's written recommendations for application of polished concrete system.
- B. Apply sealer/hardener to concrete including colored dye in accordance with manufacturer's directions. Finish to match approved samples.

3.4 CLEANING AND PROTECTING

- A. Clean in accordance with manufacturer's directions..
- B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure polished concrete is without damage or deterioration at time of Substantial Completion.

END OF SECTION 03 3600

SECTION 03 4113 - PRECAST CONCRETE PLANKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

- A. This Section includes precast, prestressed-concrete construction, including product design, engineering, manufacture, transportation, erection, storage, and protection of precast concrete required to complete Work shown on Drawings and as specified herein.

- B. Types of precast concrete plank include hollow-core slabs and solid slabs.

1.3 QUALITY ASSURANCE

- A. Comply with the latest edition of the following:
 - 1. PCI "Manual for the Design of Hollow Core Slabs."
 - 2. ACI 318 "Building Code Requirements for Reinforced Concrete."
 - 3. AWS D1.1 "Structural Welding Code-Steel."
 - 4. AWS D1.4 "Structural Welding Code - Reinforcing Steel."
- B. Manufacturer Qualifications: Precast concrete manufacturer shall have a minimum of 5-years successful experience in fabrication of precast concrete units, similar to units required for this Project. Manufacturer shall have sufficient production capacity to produce required units without causing delay in Work.
- C. The precast concrete manufacturing plant shall be certified by the Prestressed Concrete Institute Plant Certification Program, prior to the start of production.
- D. Plant Quality Control: Manufacturer shall submit with bid a proposed quality control program of testing to certify precast units meet design criteria and material strengths.
- E. Documentation shall include data collection procedure for strength tests, tensioning data, slump, air content, temperature, date of fabrication, member identification, and inspector's name. Testing procedures shall be in compliance with PCI MNL-116, "Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products."
- F. Qualifications for Welding Work: Provide quality welding processes and welding operators in accordance with AWS Standards. Provide certification that welders employed in the work have passed AWS qualification tests to perform the type of welding within previous 12 months.

- G. Erector Qualifications: Erector shall have at least 5-years experience in the erection of precast structural concrete, similar to the requirements of this Project.

1.4 PRODUCT QUALITY ASSURANCE

- A. Company Field Advisor: Secure the services of a company field advisor from the leveling surface manufacturer. The field advisor shall be certified in writing by the manufacturer to be technically qualified in the installation of the product(s). Personnel involved solely in sales do not qualify. Field advisor shall be present at beginning of installation of product and as required during duration of Project for the purpose of:
1. Rendering technical assistance to the precast manufacturer regarding installation procedures of the product.
 2. Providing specialized training and use of the product to Contractor's personnel.
 3. Verifying proper mixing proportions and procedures for the materials.
 4. Verifying proper temperature and other environmental controls.
 5. Verifying proper tools and application procedures.
 6. Verifying proper curing and protection of the installed product.
 7. Familiarizing the Contractor/Owner/Architect with all aspects of the system including inspection techniques.
 8. Answering questions that may arise.
- B. Field advisor shall prepare a written report summarizing the information listed above. Report shall be submitted to Contractor (one copy), and Architect (three copies).
- C. Contractor shall be responsible for the expenses of the field advisor.

1.5 SPECIAL INSPECTIONS

- A. Refer to Specification Section 01 4533 and the Schedule of Special Inspections.

1.6 SUBMITTALS

- A. Shop Drawings:
1. Erection Drawings:
 - a. Plans locating and defining plank units furnished by the manufacturer, with openings shown and located.
 - b. Sections and details showing connections, edge conditions, and support conditions of the plank units.
 - c. Dead, live, and other applicable loads used in the design.
 - d. Temporary shoring and bracing, if necessary.
 2. Production Drawings:
 - a. Plan view of each plank unit type.
 - b. Sections and details to indicate quantities, location, and type of reinforcing steel and prestressing strands.
 - c. Lifting and erection inserts.
 - d. Dimensions and finishes.

- e. Prestress for strand and concrete strength.
 - f. Estimated cambers.
 - g. Method of transportation.
- 3. Certification:
 - a. Manufacturer: Submit PCI plant certification and qualifications.
 - b. Erector: Submit qualifications of erector and welders.
 - c. Design: Submit certification letter signed and sealed by a registered professional Engineer licensed in New York stating that the design and fabrication of the planks are in compliance with these Specifications and will safely carry the required superimposed loads.
 - d. Concrete Test Reports: Submit copies of concrete test reports for planks.
- B. Mix Designs: Submit proposed mix design for plank joint grout 15 days minimum before start of concreting.
- C. Submit data and installation instructions for proprietary material.
- D. Submit to Special Inspector and Engineer material certificates certifying each material complies with specifications.
- E. Submit chloride ion content of proposed admixtures prior to submitting mix design.
- F. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel within this specification section, if available. A statement of the contractor's good faith effort to obtain the EPD shall be provided if not available.
 - 1. Manufacturer provided EPDs must be Product Specific Type III (Third Party Reviewed), in adherence with ISO 14025 Environmental labels and declarations, ISO 14044 Environmental management Life cycle assessment, and ISO 21930 Core rules for environmental product declarations of construction products and services.

1.7 LOAD CRITERIA AND PRODUCT REQUIREMENTS

- A. Handling and erection loads and stresses shall be responsibility of precast concrete manufacturer.
- B. Planks shall be fabricated to support superimposed uniform and concentrated loads indicated on Drawings.
- C. Live load deflection shall be limited to $1/360$ of the span.
- D. Planks shall have a minimum restrained fire rating of 2 hours.
- E. Planks shall be fabricated to account for effect of holes and openings. Planks adjacent to cut planks shall be fabricated to support the additional loading of the cut plank. Computer load tables, design calculations, and Shop Drawings shall be prepared under the supervision of a registered professional Engineer.

- F. Planks shall be hollow-core slabs unless noted otherwise or unless manufacturer determines that solid slabs are required to support the loads indicated on Drawings. Notify Engineer prior to production of shop drawings if solid slabs are required, but were not shown.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Lift and support during manufacturing, stockpiling, transporting, and erection operations only at the lifting or supporting point, or both, as shown on the Shop Drawings, and with appropriate lifting devices. Lifting inserts shall have a minimum safety factor of 4. Exterior lifting hardware shall have a minimum safety factor of 5.
- B. Perform transportation, site handling, and erection with acceptable equipment and methods and by qualified personnel.
- C. Stack so that lifting devices are accessible and undamaged.
- D. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.
- E. Store precast units on blocking only at designed bearing points. Avoid warping and cracking.
- F. Protect from damage.
- G. Planks shall be a minimum of 28-days old before delivery to site.

1.9 TOLERANCES

- A. Fabrication and erection tolerances shall comply with PCI "Manual for Design of Hollow-Core Slabs," Figures 1.8.1 and 1.8.2, except as follows:
 - 1. Location of inserts within units: ± 1 inch.
 - 2. Variation from specified end squareness or skew (horizontal and vertical) of unit: $\pm 1/4$ inch.
 - 3. Differential bottom elevation of exposed planks as erected: $\pm 1/4$ inch.
 - 4. For tolerance criteria purposes, planks shall be classified as untopped.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cement: ASTM C 150, Type I or III.
- B. Aggregates: ASTM C 33.
- C. Air Entrainment: ASTM C 260.

- D. Water Reducer: ASTM C 494.
- E. Water: Potable.
- F. Calcium Chloride: Not permitted.
- G. Prestressed Reinforcement: Multiple-wire stress-relieved high tensile strand pretensioned as required by design, ASTM A 416, Grade 270K.
- H. Reinforcement: ASTM A 615; Grade 60.
- I. Weld-Wire Fabric: ASTM A 185; flat sheets only.
- J. Steel Plates: ASTM A 36.
- K. Welded Studs: AWS D1.1.
- L. Cement Grout: Mixture of not less than one part portland cement to three parts fine sand, and the consistency shall be such that joints can be completely filled but without seepage over adjacent surfaces.
- M. Leveling Surface: Cement based self-leveling underlayment, "TECK 2800" by Geistlich International, Inc.; "V-800 Levelcrete" by Ardex, Inc; or accepted equivalent.
- N. Bearing Strips:
 - 1. Random Oriented Fiber Reinforced: Shall support a compressive stress of 3,000 psi with no cracking, splitting, or delaminating in the internal portions of the pad. One specimen shall be tested for each 200 pads used in the Project.
 - 2. Plastic: Multi-monomer plastic strips shall be nonleaching and support construction loads with no visible overall expansion.

2.2 CONCRETE STRENGTH CRITERIA

- A. 28-day compressive strength: Minimum of 4,000 psi.
- B. Release strength: Minimum of 3,000 psi.

2.3 FABRICATION

- A. Planks shall be completely cured before delivery and shall be clean and straight with no projecting fins, broken edges, or structural defects. Warped units will be rejected.
- B. Provide plates as indicated on Drawings.
- C. Members shall be steam cured with moist-saturated steam.
- D. Openings:

1. Manufacturer shall provide for those openings 10-inches round or square or larger as shown on the Structural Drawings. Additional reinforcement required shall be detailed on the Shop Drawings.
 2. Provide standard steel headers for support of cut planks for openings as required. Paint headers with rust-inhibitive primer.
 3. Cut openings shall be made in full-width planks only.
- E. Provide embedded weld plates for planks bearing on steel beams.
- F. Minimum plank width shall be 1 foot 6 inches.
- F. Surface Finish:
1. Roughen top surface of planks to receive concrete topping or self-leveling cementitious underlayment. Provide a minimum 1/4-inch amplitude.
 2. Provide smooth finish for untopped planks or planks to be exposed to view in the final structure.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Examine conditions under which concrete planks shall be placed. Do not proceed with Work until unsatisfactory conditions are corrected.
- B. Contractor shall verify that structure and anchorage inserts are within allowable tolerances.
- C. No out-of-tolerance, broken, cracked, spalled, warped, or otherwise defective units shall be erected.
- D. Contractor shall be responsible for providing suitable access to the building, proper drainage, and firm, level bearing for hauling and erection equipment to operate under their own power. Erector shall examine supporting structure before plank is erected, and notify Contractor in writing of conditions detrimental to proper and timely completion of Work.
- E. Contractor shall be responsible for:
1. Providing true, level bearing surfaces on all field-placed supporting members. (Erector shall provide shims as required for uniform bearing of plank.)
 2. Placement and accurate alignment of plates, dowels, and other field-placed supporting members.

3.2 INSTALLATION

- A. Installation of planks shall be performed by manufacturer or competent erector. Members shall be lifted by means of suitable lifting devices at points provided by manufacturer. Bearing strips shall be set where required. Temporary shoring and bracing, if necessary,

shall comply with manufacturer's recommendations.

- B. Grout keys shall be filled.
- C. Members shall be properly aligned and leveled as required by accepted Shop Drawings and PCI requirements. Variations between adjacent members shall be reasonably leveled out by jacking, loading, or any other feasible method as recommended by manufacturer and acceptable to Architect.
- D. Planks shall be installed in strict accordance with accepted Shop Drawings and details.
- E. Keep units tight and at right angles to bearing supports.
- F. Weld alternating plank-anchoring plates to steel supporting members.
- G. Grout joints between units and space where slab ends meet on supporting members and other areas as required to produce a complete concrete floor surface. Clean sand and dirt with stiff broom. Remove all grout that may have seeped through to ceiling below before it hardens. Remove all extraneous grout from the top surface before it hardens.
- H. Provide suitable end cap or dam in voids as required at ends of plank.
- I. Field welding by qualified welders using equipment and materials compatible to the base material.
- J. Replace planks that are out of tolerance, broken, cracked, or chipped.
- K. Minimum bearing shall be 2 1/2 inches on steel, 3 inches on concrete, and 3 1/2 inches on masonry. Align and level planks using shims, bolts, or jacks.
- L. Openings to be field drilled or cut after plank units are erected shall be reviewed by Architect and approved by the manufacturer before drilling or cutting.

3.3 LEVELING SURFACE

- A. Apply self-leveling underlayment on clean surfaces to sufficient thickness to give base surface for direct application of finished-floor covering.
- B. Apply underlayment with varying thickness to account for plank camber. Where plank changes direction, apply varying thickness underlayment to ensure constant floor elevation across joint.

3.4 CONCRETE REPAIRS

- A. Cracks, concrete defects, and ponding observed in erected structure shall be repaired to satisfaction of Architect. Repair procedures and materials shall be specified in writing by manufacturer's registered Engineer and submitted for review and acceptance by Architect before repair work proceeds. Materials used shall be installed under supervision of company field advisor as herein specified. Concrete repairs will not be

accepted unless adequate documentation is provided to verify that repair work does not reduce strength and durability of structure. This documentation may include testing by independent testing agency acceptable to Architect and employed by Contractor.

END OF SECTION 03 4113

SECTION 03 5416 - HYDRAULIC CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes hydraulic-cement-based underlayment for use below interior floor coverings.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Submit an Environmental Product Declaration (EPD) from the manufacturer for concrete within this specification section, if available. A statement of the contractor's good faith effort to obtain the EPD shall be provided if not available.
 - 1. Manufacturer provided EPDs must be Product Specific Type III (Third Party Reviewed), in adherence with ISO 14025 Environmental labels and declarations, ISO 14044 Environmental management Life cycle assessment, and ISO 21930 Core rules for environmental product declarations of construction products and services.
- C. Shop Drawings: Plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.
- D. Manufacturer Certificates: Signed by manufacturers of both underlayment and floor covering system certifying that products are compatible.
- E. Qualification Data: For Installer.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.
- B. Product Compatibility: Manufacturers of both underlayment and floor covering system certify in writing that products are compatible.
- C. Mockups: Apply hydraulic-cement-based underlayment mockups to demonstrate surface finish, bonding, texture, tolerances, and standard of workmanship.
 - 1. Apply mockups approximately 100 sq. ft. (9 sq. m) in area in location indicated or, if not indicated, as directed by Architect.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature and humidity, ventilation, and other conditions affecting underlayment performance.

- 1. Place hydraulic-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F (10 and 27 deg C).

1.6 COORDINATION

- A. Coordinate application of underlayment with requirements of floor covering products, including adhesives, specified in Division 09 Sections, to ensure compatibility of products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the following:

- 1. Ardex, Inc.; K-15 Self-Leveling Underlayment Concrete.
 - 2. Dayton Superior Specialty Chemical Corp.; Level Layer I
 - 3. Mapei Corporation; Ultraplan I Plus

2.2 HYDRAULIC-CEMENT-BASED UNDERLAYMENTS

- A. Underlayment: Hydraulic-cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thicknesses of 1/8 inch (3 mm) and that can be feathered at edges to match adjacent floor elevations. Product shall also be capable of being poured/pumped monolithically (rather than room-by-room).

- 1. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
 - 2. Compressive Strength: Not less than 4100 psi (28 MPa) at 28 days when tested according to ASTM C 109/C 109M.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm); or coarse sand as recommended by underlayment manufacturer.
 - a. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required

4. Water: Potable and at a temperature of not more than 70 deg F (21 deg C).
- B. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance.
 1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Prepare and clean substrate according to manufacturer's written instructions.
 1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond. Perform moisture tests recommended by manufacturer and as follows.
 1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/100 sq. m) in 24 hours.
 2. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have relative humidity level measurement acceptable to manufacturer.
- C. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.
- D. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

- A. General: Mix and apply underlayment components according to manufacturer's written instructions.
 1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.

2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
4. Install perimeter isolation strip along the base of partitions prior to installation of topping. Cut isolation strip flush with finished floor.
5. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

B. Apply underlayment to produce uniform, level surface.

1. Apply a final layer without aggregate to produce surface.
2. Feather edges to match adjacent floor elevations.

C. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

D. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

E. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 5416

SECTION 042200 – CONCRETE UNIT MASONRY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including general and supplementary conditions and Division 1 specification sections, apply to this section.

1.2 DESCRIPTION OF WORK

- A. This section specifies:
 - 1. Reinforced concrete unit masonry.
 - 2. Masonry accessories.

1.3 MATERIAL EVALUATION/QUALITY ASSURANCE

- A. Preconstruction Testing: Contractor shall employ and pay qualified independent Testing Agency to perform preconstruction testing indicated and other inspecting and testing services required for source and field quality control.
 - 1. Concrete Masonry Unit Tests: For each different concrete masonry unit indicated, test units for strength, absorption, and moisture content in accordance with ASTM C 140.
 - 2. Prism Tests: For each type of wall construction indicated, test masonry prisms in accordance with ASTM C 1314.
 - a. Contractor shall fabricate prisms under supervision and direction of Testing Agency Representative.
 - 3. Test mortar composition and properties in accordance with ASTM C 270 if Property Specification is used.
 - 4. Evaluate mortar proportions in accordance with ASTM C 270 if Proportion Specification is used.
 - 5. Test mortar properties for approved mix in accordance with ASTM C780 (Compressive Strength Method) to determine a base line for field mortar tests.
 - 6. Test grout compressive strength in accordance with ASTM C 1019 to demonstrate compliance with ASTM C476, Property Specification.
 - a. Contractor shall deliver to Testing Agency accepted CMU for fabrication of test samples.
 - 7. Test self-consolidating grout compressive strength in accordance with ASTM C1019. Test slump flow and visual stability index in accordance with ASTM C1611/C1611M.
- B. Testing Agency Qualifications: Independent Testing Agency shall demonstrate to Architect's satisfaction that it has experience and capability to satisfactorily perform testing indicated without delaying progress of work.
- C. Contractor shall employ and pay a licensed Land Surveyor to survey foundations for compliance with dimensional tolerances specified in referenced unit masonry standard.

- D. Preinstallation Conference: Perform conference at project site to comply with requirements of Division 1 section "Project Meetings."
- E. Grout Demonstration Panel: If proposed grouting procedures, construction techniques, or grout space limitations do not conform to the requirements of this Specification, a grout demonstration panel is required to be constructed prior to installation of Contract work. Grout demonstration panel must represent actual project and field conditions. After grouting, the panel must be deconstructed to confirm whether filling and adequate consolidation has been achieved. The RDP will determine whether the proposed grouting procedures are acceptable for use for Contract work.
- F. The Registered Design Professionals (RDPs) for Structural Engineering and Architecture will visit construction site at appropriate intervals to determine if work is in general conformance with Contract Documents and specifications. Notify RDPs 48 hours before anticipated time of completion for given section of work so they may determine if site observations are required. If site observations are required, do not place grout or continue construction of masonry until RDPs have had opportunity to make observations.

1.4 SPECIAL INSPECTIONS

- 1. Refer to Specification Section 014533 and Schedule of Special Inspections.

1.5 PROJECT 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 minimum 24 inches down both sides. Hold cover securely in place.
 - 2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover minimum 24 inches down face next to unconstructed wythe. Hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 3 days and concentrated loads for at least 7 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining face of masonry to be left exposed or painted. Remove immediately grout, mortar, or soil that comes in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surfaces.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, and similar products with painted and integral finishes from mortar droppings.
- D. Cold-Weather Construction:

	Construction: Based upon Ambient Temperatures	Protection: Based upon anticipated minimum daily temperatures.
Above 40°F	1. Normal Masonry Procedures.	1. Normal Masonry Procedures.
40°F to 32°F	1. Heat mortar sand or mixing water to produce mortar temperature between 40°F and 120°F at time of mixing. Maintain mortar above 40F until used in masonry. 2. Keep grout aggregates above 32°F.	1. Cover top 2 feet of unfinished masonry work with a water-resistive membrane for at least 24 hours and at the end of each day's work.
32°F to 25°F	1. Heat mortar sand or mixing water to produce mortar temperature between 40°F and 120°F at time of mixing. Maintain mortar above 40°F until used in masonry. 2. Heat grout aggregates and mixing water to produce grout temperature between 70°F and 120°F at time of mixing. 3. Maintain grout temperatures above 70°F at time of placement.	1. Cover top 2 feet of unfinished masonry work with a water-resistive membrane for at least 24 hours and at the end of each day's work.
25°F to 20°F	1. Heat mortar sand or mixing water to produce mortar temperature between 40°F and 120°F at time of mixing. Maintain mortar above 40°F until used in masonry. 2. Heat grout aggregates and mixing water to produce grout temperature between 70°F and 120°F at time of mixing. 3. Maintain grout temperatures above 70°F at time of placement. 4. Heat masonry surfaces under construction to 40°F and use wind breaks or enclosures when wind velocity exceeds 15 mph. 5. Heat masonry to a minimum of 40°F prior to grouting.	1. Cover newly constructed masonry (less than 48 hours old) completely with weather-resistive insulating blankets or equal protection for at least 48 hours after construction of work.
Below 20°F	1. Heat mortar sand or mixing water to produce mortar temperature between 40°F and 120°F at time of mixing. Maintain mortar above 40°F until used in masonry.	1. Cover newly constructed masonry (less than 48 hours old) completely with weather-resistive insulating blankets or equal protection for at least 48 hours

	<ol style="list-style-type: none"> Heat grout aggregates and mixing water to produce grout temperature between 70°F and 120°F at time of mixing. Maintain grout temperatures above 70°F at time of placement. Heat masonry surfaces under construction to 40°F and use wind breaks or enclosures when wind velocity exceeds 15 mph. Heat masonry to a minimum of 40°F prior to grouting. Provide an enclosure and auxiliary heat to maintain air temperature above 40°F in enclosure. 	<p>after construction of work.</p> <ol style="list-style-type: none"> Maintain newly constructed masonry (less than 48 hours old) above 32°F for at least 48 hours after being constructed using heated enclosures or other acceptable methods. Provide thermometers to record high and low temperatures of masonry.
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In addition, comply with the following:

- Do not lay masonry units having either a temperature below 40°F or containing frozen moisture, visible ice, or snow on their surface.
- Remove visible ice and snow from the top surfaces to receive new masonry. Heat these surfaces above 32°F using methods that do not result in damage.
- Remove masonry damaged by freezing conditions.
- Use liquid cleaning methods only when air temperature is 40°F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Construction:

	Construction: Based upon Ambient Temperatures	Protection: Based upon anticipated minimum daily temperatures.
Below 90°F	1. Normal Masonry Procedures.	1. Normal Masonry Procedures.
90°F to 105°F	<ol style="list-style-type: none"> Maintain sand piles in a damp, loose condition. Provide necessary conditions and equipment to produce mortar having a temperature below 120°F. Maintain temperature of mortar and grout below 120°F. Flush mixer, mortar transport container, and mortar boards with cool water before they come into contact with mortar or mortar ingredients. Maintain mortar consistency by 	1. Fog spray newly constructed masonry until damp at least three times a day until the masonry is 3 days old.

	<p>retempering with cool water.</p> <p>6. Use mortar within 2 hours of initial mixing.</p>	
Above 105°F	<p>1. Maintain sand piles in a damp, loose condition.</p> <p>2. Provide necessary conditions and equipment to produce mortar having a temperature below 120°F</p> <p>3. Shade material and mixing equipment from direct sunlight.</p> <p>4. Use cool mixing water for mortar and grout. Ice is permitted in the mixing water prior to use. Do not permit ice in the mixing water when added to the other mortar or grout materials.</p>	<p>1. Fog spray newly constructed masonry until damp at least three times a day until the masonry is 3 days old.</p>

1.6 SUBMITTALS

- A. Product data: Submit manufacturer's product data for each different masonry unit, accessory, and other manufactured product indicated.
- B. Shop Drawings:
 - 1. Reference Contract Drawing number and addendum number in each shop drawing.
 - 2. Submit detailed drawings for stone trim in form of cutting and setting drawings showing sizes, profiles, locations, and anchorages of each stone trim unit required.
 - 3. Submit shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcing" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement. Show elevations of reinforcement in wall at 1/4"=1'-0" scale.
- C. Samples for initial selection purposes: Submit the following:
 - 1. Unit masonry samples in small-scale form showing full extent of colors and textures available for each different exposed masonry unit required.
 - 2. Colored masonry mortar samples showing full extent of colors available.
 - 3. Stone Trim.
- D. Samples for verification purposes: Submit the following:
 - 1. Full-sized units for each different exposed masonry unit required, showing full range of exposed color, texture, and dimensions to be expected in completed construction.
 - a. Include size variation data verifying actual range of sizes for bricks falls within ASTM C 216 dimension tolerances for brick where modular dimensioning is

- indicated.
2. Colored masonry mortar samples for each color required, showing full range of colors expected in finished construction. Label samples to indicate type and amount of colorant used.
 3. Stone trim samples not less than 12 inches long, showing full range of colors and textures expected in finished construction.
 4. Weep holes/vents that match mortar color.
 5. Accessories embedded in masonry.
- E. Material Data: Submit to Special Inspector and Architect/Engineer certificates for the following signed by manufacturer and Contractor certifying each material complies with requirements.
1. Masonry Units.
 2. Each different cement product required for mortar and grout, including name of manufacturer, brand, and type.
 3. Integral Water Repellant used in CMU.
 4. Each material and grade indicated for reinforcing bars.
 5. Each type and size of joint reinforcement.
 6. Each type and size of anchors, ties, and metal accessories.
- F. Material Test Reports: Submit to Special Inspector and Architect/Engineer reports from qualified independent Testing Agency employed and paid by Contractor indicating and interpreting test results relative to compliance for the following proposed masonry materials with requirements indicated:
1. Mortar: Property (Proportion) requirements of ASTM C 270.
 2. Grout complying with ASTM C 476. Include description of type and proportions of grout ingredients.
 3. Self-consolidating grout complying with ASTM C476 and ASTM C1611/C1611M.
 4. Masonry units: ASTM C67 and ASTM C140.
 5. Field Mortar Base Line Compressive Test: ASTM C780.
 6. Efflorescence tests for Brick: ASTM C67.
 7. Durability tests for surface-coated brick: ASTM C67.
- G. Construction Procedures: Submit cold-weather construction and hot-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.
- H. Qualification Data: Submit data for firms and persons specified to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, telephone numbers, names of Architects and Owners, and other information specified.
- I. Grouting Program: Submit proposed grouting program for grouting CMU walls. Grouting shall be in accordance with recommendations of NCMA-TEK 3-2A. Provide grout demonstration panel when proposed grouting techniques do not meet NCMA recommendations.

- H. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel within this specification section, if available. A statement of the contractor's good faith effort to obtain the EPD shall be provided if not available.
- 1. Manufacturer provided EPDs must be Product Specific Type III (Third Party Reviewed), in adherence with ISO 14025 Environmental labels and declarations, ISO 14044 Environmental management Life cycle assessment, and ISO 21930 Core rules for environmental product declarations of construction products and services.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry materials to project in undamaged condition.
- B. Store and handle masonry units off of ground, under cover, and in dry location to prevent deterioration or damage from moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in air-dried condition.
- C. Store cementitious materials off of ground, under cover, and in dry location.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 WORKMANSHIP

- A. Contractor shall be responsible for correction of work not conforming to specified requirements. Correct deficient work as directed by Architect.
- B. Remove work found to be defective. Replace with new acceptable work.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Unit Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 "Specifications for Masonry Structures."
- B. Fire Performance Characteristics: Where indicated, provide materials and construction identical to those of assemblies whose fire resistance has been determined in accordance with ASTM E 119 by a testing and inspecting organization, by equivalent concrete masonry thickness, or by another means as acceptable to authorities having jurisdiction.
- C. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color or uniform blend within ranges accepted for these characteristics from one manufacturer for each different product required for each

continuous surface or visually related surfaces.

- D. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.
- E. Performance Requirements:
 - 1. Building Product Disclosure Requirements: Provide Building Product Disclosure documentation for products used in this section where available.
 - a. Environmental Product Declarations.
 - b. Material Ingredients Documentation demonstrating the chemical inventory of the product to at least 0.1% (1000ppm).
 - 2. Low-emitting requirements: Comply with VOC limits and other requirements as detailed in Section 01 81 13.14 Sustainable Design Requirements – LEED v4 BD+C.”

2.2 (not used)

2.3 CONCRETE MASONRY UNITS

- A. General: Comply with requirements indicated below applicable to each form of concrete masonry unit required.
 - 1. Provide special shapes where indicated and as follows:
 - a. For lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
 - b. Bullnose units for outside corners where indicated.
 - c. Square-edged units for outside corners unless noted otherwise.
 - 2. Size: Provide concrete masonry units complying with requirements indicated below for sizes manufactured to specified face dimensions within tolerances specified in applicable referenced ASTM specification for concrete masonry units.
 - 3. Concrete Masonry Units: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated in drawings. If not shown in drawings, use length to produce coursing with little or no cutting.
 - 5. Prefaced Concrete Masonry Units: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated in drawings, with prefaced surfaces having 1/16-inch-thick returns of facing to create 1/4-inch-wide mortar joints with modular coursing.
 - 6. Use two-cell units for reinforced masonry applications.
 - 7. Exposed Faces: Manufacturer's standard color and texture unless otherwise indicated.
 - 8. Where special finishes are indicated, provide units with exposed faces of the following general description matching color and texture of Architect's sample.
 - a. Standard aggregate, ground finish.
 - b. Special aggregate, ground finish.
 - c. Standard aggregate, split-face finish.
 - d. Special aggregate, split-face finish.

- e. Standard aggregate, split-ribbed finish.
- f. Special aggregate, split-ribbed finish.
- 9. Where special patterns are indicated, provide units with exposed faces matching color, texture, and pattern of Architect's sample.

B. Concrete Masonry Units: ASTM C 90 and as follows:

- 1. Unit Compressive Strength: Minimum average net area compressive strength of 2,000 psi.
- 2. Weight Classification: Normal weight.
- 3. Recycled Content: 30 percent minimum preconsumer recycled content.

2.4 (not used)

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I. Type III can be used for cold-weather construction. Provide natural color or white cement as required to produce required mortar color.

- 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: Not Permitted.

E. Mortar Cement: ASTM C 1329/C 1329M.

F. 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. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.
- 2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
- 3. Pigments shall not exceed 5 percent of mortar cement by weight.

G. For colored aggregate mortars, use portland cement of natural color or white as required to produce mortar color indicated.

- H. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this article, combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.
- I. Aggregate for Mortar: ASTM C 144. For joints less than 1/4 inch, use aggregate graded with 100 percent passing No. 16 sieve.
 - 1. White Mortar Aggregates: Natural white sand or ground white stone.
- J. Aggregate for Grout: ASTM C 404.
- K. Water: Clean and potable.
- L. Additives: Not permitted.
- M. Integral Water Repellent Admixture: Provide admixture for all mortar to be used with integral water repellent masonry units. Admixture must be same manufacturer as masonry units:
 - 1. Products:
 - a. "RainBloc" by ACM Chemistries.
 - b. "Dry-Block" by W.R. Grace Construction Products.
 - c. "Eucon Blocktite" by Euclid Chemical.

2.6 REINFORCING STEEL

- A. General: Provide reinforcing steel complying with requirements of referenced unit masonry standard and this article.
- B. Recycled Content: Provide minimum 90 percent postconsumer recycled content. For stainless steel products, provide minimum 60 percent postconsumer recycled content.
- C. Steel Reinforcing Bars: Material and grade as follows:
 - 1. Billet steel complying with ASTM A 615.
 - 2. Epoxy-coated billet steel complying with ASTM A 615 and ASTM A 775.
 - 3. Grade 60.
- D. Deformed Reinforcing Wire: ASTM A 496.
- E. Plain-Welded Wire Fabric: ASTM A 185.

2.7 JOINT REINFORCEMENT

- A. General: ASTM A951. Provide joint reinforcement complying with requirements of referenced unit masonry standard and this article, formed from the following:
 - 1. Galvanized carbon steel wire. Coating class as required by referenced unit masonry standard for application indicated.

- B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units and complying with requirements indicated below:
1. Wire Diameter for Side Rods: 0.1483 inch (9 gauge).
 2. Wire Diameter for Cross Rods: 0.1483 inch (9 gauge).
 3. For single-wythe masonry, provide type as follows with single pair of side rods:
 - a. Ladder-type design with perpendicular cross rods spaced not more than 16 inches on center with one side rod in each face shell.

2.8 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of referenced unit masonry standard and of this article.
- B. Galvanized Carbon Steel Wire: ASTM A 82, coating class as required by referenced unit masonry standard for application indicated, for wire ties and anchors in exterior walls.
1. Wire Diameter: 0.1875 inch.
 2. Mill Galvanized: Class 1 coating.
 3. Hot-Dip Galvanized: Class B-2 coating.
- C. Steel Sheet: ASTM A1008.
- D. Galvanized Heavy-Thickness Steel Sheet: ASTM A 653, G60 (commercial quality) hot-rolled carbon steel sheet hot-dip galvanized after fabrication to comply with ASTM A 525, Class B3, fabricated from steel sheet or strip with a thickness of 0.180 inch and greater, for rigid anchors.
- E. Steel Plates and Bars: ASTM A 36, hot-dip galvanized to comply with ASTM A 123 or ASTM A 153, Class B3, as applicable to size and form indicated.

2.9 BENT WIRE TIES

- A. General:
1. Ties and anchors shall extend at least halfway into veneer or facing wythe but in no case shall extend less than 1-1/2 inches into veneer, and shall have at least a 5/8-inch cover on outside face.
 2. Adjustable ties shall have a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches.
- B. Individual two-piece, rectangular bent wire ties: Composed of rectangular closed end unit with eyes, not less than 4 inches wide, and adjustable, double-pintle, rectangular wire ties.
- C. One piece, rectangular, double-pintle wire ties: For use with tab-type joint reinforcing.

- D. One piece, triangular, dovetail wire tie: With 14-gauge dovetail end for use with dovetail slots.
- E. One piece, triangular wire ties: For use with anchors to structural steel and light-gauge framing.

2.10 ADJUSTABLE ANCHORS FOR CONNECTING MASONRY TO STEEL OR CONCRETE FRAMEWORK

- A. General: Two-piece assemblies as described below allowing vertical or horizontal differential movement between wall and framework parallel to plane of wall but resisting tension and compression forces perpendicular to it.
- B. For anchorage to concrete, provide 22-gauge dovetail anchor section formed from galvanized steel sheet, foam filled, and one piece, triangular, dovetail wire-ties.
- C. For anchorage to steel framework, provide manufacturer's standard anchors with crimped 1/4-inch-diameter, wire anchor section for welding to steel and one piece, triangular wire-ties compatible with anchor.
 - 1. "#359 Weld-On Tie" and "#301W Column Web Tie", by Hohmann & Barnard. Use #359 FP Weld-On Ties if columns are fireproofed.
 - 2. "Type I Weld on Anchor" by Wire Bond.
 - 3. "Weld-On" by MasonPro.

2.11 RIGID ANCHORS

- A. Provide straps of form and length indicated in drawings, fabricated from galvanized, heavy thickness, or stainless steel sheet, 1 1/2 inches wide by 1/4 inch thick with 2-inch bends.
 - 1. Where rigid anchors are used to bond intersecting walls, strap shall be 24 inches long, plus 2-inch bends at each end.

2.12 (not used)

2.13 MISCELLANEOUS ANCHORS

- A. Unit-Type Masonry Inserts in Concrete: Cast-iron or malleable-iron inserts of type and size indicated.
- B. Anchor Bolts: Headed bolts complying with A 307, Grade A, with ASTM A 563 hex nuts and flat washers where indicated. Hot-dip galvanized to comply with ASTM A 153, Class C, of diameter and length indicated.
- C. Joint Stabilizing Anchor: Acceptable products include the following:
 - 1. "Slip-Set Stabilizer" by Hohmann & Barnard, Inc.

2. "353 Debonded Shear Anchor" by Heckmann Building Products, Inc.
3. "Control Joint Anchor 1700" by Wire-Bond.

2.14 POST-INSTALLED ANCHORS

A. Chemical Adhesive Anchors:

1. Anchors to solid concrete, grouted CMU, solid brick, or stone:
 - a. Anchors for use when base material temperature is 0°F or greater: "HIT-Ice" by Hilti; "Epcon A7" by ITW Ramset/Red Head; "AC 100 Plus" by Powers Fasteners; "AT Acrylic-Tie" by Simpson/Strong-Tie; or accepted equivalent.
 - b. Anchors for use when base material temperature is 40°F or greater; "HIT-HY 200 Safe Set" by Hilti; "Epcon C6" by ITW Ramset/Red Head; "T308 Plus" by Powers Fasteners; "ET Epoxy-Tie" by Simpson/Strong-Tie; or accepted equivalent.
2. Anchors to hollow masonry (brick or hollow CMU):
 - a. Anchors for use when base material temperature is 0°F or greater: "Epcon A7" by ITW Ramset/Red Head; "AC 100 Plus" by Powers Fasteners; "AT Acrylic-Tie" by Simpson/Strong-Tie; or accepted equivalent.
 - b. Anchors for use when base material temperature is 40°F or greater: "Epcon C6" by ITW Ramset/Red Head; "T308 Plus" by Powers Fasteners; "ET Epoxy-Tie" by Simpson/Strong-Tie; "HIT-HY 270" by Hilti; or accepted equivalent.
 - c. Provide manufacturer's standard screen tubes for use with anchors.

2.15 (not used)

2.16 MISCELLANEOUS MASONRY ACCESSORIES

A. Rebar Positioners: Steel wire positioners that are seated into the cores of masonry units.

1. Wire Diameter: 0.1483 inch (9 gauge).
2. Mill galvanized finish for interior walls.
3. Hot-dip galvanized finish for exterior walls.
4. Acceptable products:
 - a. "Corelock" by Wire-Bond.
 - b. "RB Rebar Positioner" by Hohmann & Barnard.
 - c. "No. 376 Rebar Positioner" by Heckmann Building Products.
 - d. Other products that are accepted as equivalent.

B. Nonmetallic Expansion Joint Strips: Premolded filler strips complying with ASTM D 1056, Type 2 (closed cell), Class A (cellular rubber and rubber-like materials with specific resistance to petroleum base oils), Grade 1 (compression-deflection range of 2-5 psi), compressible up to 35 percent, of width and thickness indicated, formulated from neoprene.

C. Preformed Control Joint Gaskets: Solid rubber strips with a Shore A durometer hardness of 60 to 80, designed to fit standard sash block and to maintain lateral stability in masonry wall. Size and configuration as indicated or as required.

1. Styrene-Butadiene Rubber Compound: ASTM D 2000, Designation M2AA-805.

D. Bond Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

E. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.

2.17 MORTAR AND GROUT MIXES

A. General: Do not add admixtures including coloring 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. Field addition of admixtures is prohibited for self-consolidating grout.

B. Mortar for Unit Masonry: Comply with ASTM C 270, (Proportion) (Property) Specification for job-mixed mortar and ASTM C 1142 for ready-mixed mortar of types indicated below:

1. Limit cementitious materials in mortar to portland cement-lime.
2. Use Type S mortar in the following locations:
 - a. Walls and piers that are below grade and in contact with earth.
 - b. Load-bearing walls and piers.
 - c. Exterior, above-grade, nonload-bearing walls and parapets.
 - d. Shear walls.
 - e. Areas where another type of mortar is not indicated.
3. Use Type N mortar in the following locations:
 - a. Interior nonload-bearing partitions.
 - b. Veneers.

C. 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.

D.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall 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 where indicated on Architectural drawings.

E. Colored Aggregate Mortar: Produce mortar of color required by use of colored aggregates in combination with selected cementitious materials.

1. Mix to match Architect's sample.
2. Application: Use colored aggregate mortar for exposed mortar joints where indicated on Architectural drawings.

- F. Integral Water Repellent Mortar: Provide admixture for all mortar to be used with integral water repellent masonry units. Admixture must be same manufacturer.
- G. Grout for Unit Masonry: Comply with ASTM C 476 and referenced unit masonry standard.
 - 1. Slump: 8 to 11 inches.
 - 2. Minimum 28-day compressive strength: 2,000 psi.
 - 3. Use grout of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
- H. Self-Consolidating Grout for Unit Masonry: Comply with material requirements of ASTM C476, and slump flow and VSI per ASTM C1611/C1611M
 - 1. Slump Flow: 24 inches to 30 inches.
 - 2. Visual Stability Index (VSI) Rating: 1 or less. (Appendix X.1)
 - 3. Minimum strength: 2,000 psi.

2.18 WATER REPELLENT SEALER

- A. For exposed, single-wythe masonry walls with integral water repellent units and mortar, provide penetrating sealer compatible with integral water repellent admixtures.
 - 1. Products:
 - a. "Infiniseal DB" by W.R. Grace Construction Products.
 - b. "Chemstop WB Heavy Duty" by Euclid Chemical.
 - c. Either sealer noted above may be used with "RainBloc" by ACM Chemistries.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions with installer on-site for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry.
 - 1. For record, prepare written report, endorsed by installer, listing conditions detrimental to performance of unit masonry.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that impair mortar bond.
- 2. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.
- 3. Examine mechanical vibrators to be used for grout consolidation prior to grout delivery to verify vibrators are in proper working order.
- 4. Do not proceed until unsatisfactory conditions have been corrected.

3.2 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets.
- B. Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.
- C. Bond Pattern for Exposed Masonry: Lay exposed masonry as follows unless indicated otherwise in drawings:
 - 1. Do not use units with less than nominal 4-inch horizontal face dimensions.
 - 2. One-half running bond with vertical joint in each course centered on units in courses above and below.
 - 3. Avoid use of less-than-half-sized units at corners, jambs, and where possible at other locations.
 - 4. Where indicated in drawings, match coursing, bonding, color, and texture of new masonry with existing masonry.
- E. Lay concealed masonry with units in 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.
- F. Stopping and Resuming Work: In each course, rack back one-half unit length for one-half running bond or one-third unit length for one-third running bond. Do not tooth. Clean exposed surfaces of set masonry. Wet clay masonry units lightly if required. Remove loose masonry units and mortar prior to laying fresh masonry.
- G. Built-In Work: As construction progresses, build-in items specified under this and other sections of specifications. Fill in solidly with masonry around built-in items.
 - 1. Fill space between hollow-metal frames and masonry solidly with mortar unless otherwise indicated.
 - a. At exterior frames, insert extruded polystyrene board insulation around perimeter of frame in thickness indicated but not less than 3/4 inch to act as thermal break between frame and masonry.
 - 2. Where built-in items are to be embedded in cores of hollow masonry units, place layer of metal lath in joint below and rod mortar or grout into core.
 - 3. Fill cores in hollow concrete masonry units with grout three courses (24 inches) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- H. Build chases and recesses as shown or required to accommodate items specified in this and other sections of specifications. Provide not less than 8 inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.

- I. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to opening.
- J. Nonbearing Interior Partitions: Build full height of story to underside of solid floor or roof structure above and as follows.
 - 1. Install compressible filler in joint between top of partition and underside of structure above. Brace top of wall as shown in drawings.
- K. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
 - 1. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent mortar and grout leakage. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

3.3 INSTALLATION OF MASONRY UNITS

- A. General: Comply with referenced unit masonry standard and other requirements indicated applicable to each type of installation included in project.
 - 1. Masonry units shall be laid true, level, plumb and in uniform coursing in accordance with drawings. Corners and angles shall be square unless otherwise indicated in drawings.
 - 2. Lay only dry concrete masonry units. Do not wet concrete masonry units unless approved.
 - 3. Adjust masonry units into final position while mortar is soft and plastic. If units are displaced after mortar has stiffened, remove mortar, clean joints and units, and relay units with fresh mortar.
 - 4. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual thickness of masonry units using units of nominal thickness indicated.
 - 5. Use full-sized units without cutting where possible. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction.
 - 6. Use concrete brick as miscellaneous infill at pockets and elsewhere as needed.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

3.4 MORTAR BEDDING AND JOINTING

- A. Mortar joint at foundation shall not be less than $\frac{1}{4}$ inch or more than $\frac{3}{4}$ inch in thickness. Provide full mortar coverage for bed joint at foundation, except do not project mortar into

cells to be grouted. Fill head and bed joints of hollow units with mortar for thickness of face shell. Solid units shall have full head and bed joints.

- B. Set stone units in full bed of mortar with vertical joints slushed full. Fill dowel, anchor, and similar holes solid. Wet stone joint surface thoroughly before setting. For stone surfaces that are soiled, clean bedding and exposed surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
- C. If it is necessary to remove a unit after it has been set in place, remove unit, clean, and set in fresh mortar.
- D. Nominal mortar joint thickness shall be $3/8 \pm 1/8$ inch for precision units and $1/2 \pm 1/8$ inch for slumped units.
- E. Mortar joints with wire reinforcement shall be at least twice the wire diameter of the wire.
- F. Mortar joints shall be straight, clean, and uniform in thickness.
- G. Unless otherwise specified or noted in drawings, tool mortar joints with a concave surface except for the following:
 - 1. Walls to be plastered shall have flush cut or sacked mortar joints.
 - 2. Walls to be concealed by other materials shall have flush cut joints.
 - 3. For joints facing cavities/air spaces, strike joints flush. No voids allowed.
- H. Perform tooling when mortar is partially set but still sufficiently plastic to bond. Tooling shall be performed with a tool that compacts mortar.
- I. Place and construct control joints as shown in drawings. Keep joints clean from mortar drippings and other debris.

3.5 INSTALLATION OF REINFORCING STEEL

- A. Place reinforcement as detailed in drawings. Secure against displacement prior to grouting. Horizontal bars may rest on cross web of hollow units.
- B. Tolerances for placement of reinforcing steel in walls and flexural members shall be as follows:
 - 1. Plus/minus $1/2$ inch for d equal to 8 inches or less.
 - 2. Plus/minus 1 inch for d equal to 24 inches or less but greater than 8 inches.
 - 3. Plus/minus $1 \frac{1}{2}$ inches for d equal to 24 inches or less.
 - 4. Plus/minus 2 inches for longitudinal location of reinforcement.
- C. Clearance between reinforcing steel and surface of masonry shall not be less than $1/4$ inch for fine grout and $1/2$ inch for coarse grout.
- D. Lap reinforcing bars as shown in drawings.

- E. Positioners: Provide positioners to maintain position of vertical reinforcing bars at each lap splice or at maximum spacing of 10 feet, whichever is less. Where these positioners are within ½ inch of surface of masonry, galvanize according to ASTM Standard A 153.
- F. Provide continuous bond beams reinforced with two No. 5 bars at floors, roof, and tops of parapets unless otherwise noted. Provide corner bars same size as continuous reinforcing in wall corners and intersections, lapped 2 feet with continuous reinforcing.
- G. Provide minimum vertical reinforcing of one No. 4 bar in window and door jambs, at ends of walls, corners, and each side of vertical control joints. Locate bar maximum 16 inches from end of CMU. If typical vertical wall reinforcing noted is larger than No. 4, use larger size.

3.6 HORIZONTAL JOINT REINFORCEMENT

- A. General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods fully embedded in mortar for their entire length with minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcing minimum 8 inches.
- B. Install single-wythe horizontal joint reinforcing in concrete masonry veneer at 16 inches on center vertically unless noted otherwise.
- C. Provide additional joint reinforcement not more than 8 inches above and below wall openings and extending at least 12 inches beyond openings.
- D. Cut or interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- E. Provide continuity at corners by use of prefabricated "L" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.
- F. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide continuity with:
 - 1. Horizontal joint reinforcement using prefabricated "T" sections.
 - 2. Rigid metal anchors at 48 inches on-center.

3.7 GROUTING

- A. General
 - 1. Use grout to fill masonry. Do not use mortar.
 - 2. Reinforcement must be in place prior to grouting.
 - 3. Install vertical grout dams at maximum horizontal spacing of 30 feet to control horizontal flow of grout. For walls partially grouted, use expanded metal lath mesh or other material that will not interfere with bond to restrict grout into only those cells that are to be grouted.

4. After mortar joints have set, remove protruding mortar fins that excessively constrict grout space.
5. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
6. Grout to 1½ inches below top of masonry units for each lift to form and interlock with subsequent masonry and grouting. Where bond beams occur, stop grout pour minimum 1½ inch below top of masonry. At top of masonry, fill grout space flush with tops of units and consolidate.
7. Solidly grout cells and spaces containing reinforcing steel for partially grouted walls. For solid grouted walls, grout all cells.
8. Consolidate grout using mechanical vibrator, and reconsolidate using mechanical vibrator after excess water is absorbed into masonry units.
 - a. Do not consolidate or reconsolidate self-consolidating grout.

B. Low **Pour** Grouting:

1. Construct masonry wall up to 5 feet 4 inches **pour height** (vertically) at a time. Minimum height of grout lift creating a cold joint shall equal splice length of reinforcing indicated in drawings.
2. Install vertical and horizontal reinforcing steel, anchors, and embedded items as masonry work progresses.
3. Grout walls in 5 foot 4 inch maximum lifts, consolidating and reconsolidating each lift. Stop grout 1½ inch below top of top course.
 - a. Do not consolidate or reconsolidate self-consolidating grout.

C. High **Pour** Grouting

1. Construct masonry wall up to 24 feet maximum **pour height** without grouting.
2. Provide cleanout openings at base of wall:
 - a. At vertical reinforcing bars.
 - b. At spacing of no more than 32 inches on center for solid grouted walls.
 - c. At spacing of no more than 48 inches on center for partially grouted walls.
3. Install horizontal reinforcing steel, anchors, and embedded items as masonry work progresses. Vertical reinforcing steel may be placed during or after wall is constructed, but must be secured in place prior to grouting.
4. Provide positioners to secure vertical reinforcement in correct location.
5. Remove mortar droppings and other debris through cleanouts at base of wall. After cleanouts have been inspected, seal and brace cleanouts.
6. Grout walls in 5 foot 4 inch maximum lifts, consolidating and reconsolidating each lift.
 - a. Do not consolidate or reconsolidate self-consolidating grout.
 - b. Alternate Lift Height: Where the following conditions are met, maximum lift height may be increased to 12 foot 8 inches:
 - I. Masonry wall must be cured for a minimum of 4 hours.
 - II. No intermediate horizontal reinforcing steel (bond beam) is present.
7. If grouting is to be stopped for more than one hour during a pour, stop grout 1½ inch below top of uppermost grouted unit (top of pour). Where additional masonry

is to be laid above a given pour, stop grout 1½ inch below top of top course.

3.9 (not used)

3.10 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 - 1. Provide open space not less than 1 inch wide between masonry and structural member unless otherwise indicated. Keep open space free of mortar or other rigid materials.
 - 2. Anchor masonry to structural members with adjustable anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated but not more than 16 inches on center vertically and horizontally.

3.11 MOVEMENT (CONTROL AND EXPANSION) JOINTS

- A. General: Install control and expansion joints in unit masonry where indicated. Build in related items as masonry progresses. Do not form continuous span through movement joints unless provisions are made to prevent in-plane restraint of 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.
 - 2. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
 - 3. Unless noted otherwise in drawings, continue reinforcing in bond beams through control joints. Rake vertical joint on each side, and provide backer rod and sealant in joint.
- C. Install nonmetallic expansion joint strips at building expansion joints.

3.12 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.13 PARGING

- A. Parge predampened masonry walls where indicated with Type S or Type N mortar applied in two uniform coats to total thickness of 3/4 inch. Scarify first parging coat to ensure full bond to subsequent coat.

- B. Use steel-trowel finish to produce smooth, flat, dense surface with maximum surface variation of 1/8 inch a foot. Form wash at top of parging and cove at bottom.
- C. Damp-cure parging at least 24 hours. Protect until cured.

3.14 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During joint tooling, enlarge voids or holes except weep holes and completely fill with mortar. Point-up joints including corners, openings, and adjacent construction to provide neat, uniform appearance, prepared for application of sealants.
- 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 masonry cleaning.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water prior to applying cleaners. Remove cleaners promptly by rinsing thoroughly with clear water.
 - 5. Clean brick by means of bucket and brush hand-cleaning method described in BIA "Technical Note No. 20 Revised."
 - 6. Clean concrete masonry by means of cleaning method indicated in NCMA "TEK 8-4A" applicable to type of stain on exposed Psurfaces.
 - 7. Clean limestone units to comply with recommendations in *ILI Handbook* of Indiana Limestone Institute of America, Inc.
- E. Protection: Provide final protection and maintain conditions in manner acceptable to installer that ensures unit masonry is without damage and deterioration at time of substantial completion.

3.15 CONSTRUCTION TOLERANCES

- A. Comply with construction tolerances of referenced unit masonry standard.

END OF SECTION 04 2200

SECTION 04 2213 – BRICK MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes brick masonry veneer assemblies consisting of the following:
 - 1. Face brick.
 - 2. Mortar, including mortar for cast stone.
 - 3. Ties and anchors.
 - 4. Miscellaneous masonry accessories.
 - 5. Embedded flashing.
 - 6. Cavity-wall insulation
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Anchor sections of adjustable masonry anchors for connecting to cast-in-place concrete, installed under Division 03 Section "Cast-in-Place Concrete."
 - 2. Mortar and grout and miscellaneous accessories for cast stone trim, lintels and panels installed under Division 04 Section "Cast Stone".
- C. Products installed, but not furnished, under this Section include the following:
 - 1. Manufactured reglets in masonry joints for metal flashing, furnished under Division 07 Section "Sheet Metal Flashing, Fabrications and Trim."

1.2 ACTION SUBMITTALS

- A. Product Data: For each different masonry unit, mortar material, accessory, and other manufactured product specified.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Brick corbelling and other special brick construction requiring special shapes
- C. Samples for Initial Selection: For the following:
 - 1. Colored mortar samples in small-scale form showing the full range of colors and textures available for each different exposed mortar color required.
- D. Samples for Verification: For the following:
 - 1. Weep holes/vents in color to match mortar color
 - 2. Face brick, in the form of two (2) straps of five or more bricks.
 - 3. Special brick shapes, two of each, full-size.

4. Colored mortar Samples demonstrating full range of brick color and texture to be provided, for each type of brick to be provided, in the format of thin samples glued to board backing.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 1. Each type of masonry unit required. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
 2. Mortar complying with property requirements of ASTM C 270.
- C. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 1. Each type of masonry unit required.
 - a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
 2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 3. Each type and size of anchor, tie, and metal accessory.

1.4 QUALITY ASSURANCE

- A. Masonry Standard: Comply with requirements of "Specifications for Masonry Structures, ACI 530.1/ASCE 6/TSM 602" published by the American Concrete Institute, except when more stringent requirements are specified and as modified by the requirements of these Contract Documents.
 1. Revise ACI 530.1/ASCE 6/TSM 602 to exclude Article 1.5; Subparagraphs 1.1 C.1 through 4., Subparagraphs 3.3 E.1 through 5.
- B. Installer Qualifications: Engage an experienced installer who has 10 years experience as a journeymen mason, and who has completed masonry similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
 1. A minimum of one skilled journeyman mason shall be present at all times during masonry erection and shall personally direct the work.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.
- D. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these

characteristics, through one source from a single manufacturer for each product required.

- E. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- F. Mockups: Before installing unit masonry, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Locate mockup in the locations as directed by Architect.
 - 2. Build one mock-up of typical brick masonry veneer construction containing the following types of masonry approximately 4'-0" long by 8'-0" high by full thickness, including face and backup wythes and accessories. Include a sealant filled joint at least 16 inches (400 mm) long in the mockup.
 - a. Typical exterior masonry-veneer wall, for each type to be provided, complete with back-up, ties, insulation, flashing, and weep holes. Include all types of brick to be used in the Work and all colors of mortar to be used in the Work. Include cast stone trim units.
 - 3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
 - 4. Protect accepted mockups from the elements with weather-resistant membrane.
 - 5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 6. Final approval of masonry unit color and texture and mortar color and texture will be made based on acceptance of mock-ups.
 - 7. Remove and reconstruct mockups as required to obtain Architect's approval.
 - 8. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Coordination."
- H. Vertical and Lateral Fire Propagation Test Characteristics: The exterior wall assembly is required to comply with NFPA 285 "Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components." The base wall, stud cavity insulation, wall sheathing, air barrier, continuous wall rigid insulation and exterior cladding are components that are required to be evaluated as part of this specific assembly test. Insulation shall be part of an assembly that has passed NFPA 285 testing.

1.5 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. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
- B. 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 coverings spread 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.
- C. 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 Part 1.8 C. of ACI 530.1/ASCE 6/TMS 602.
 - 1. Do not lay masonry units that are wet or frozen.
 - 2. Remove masonry damaged by freezing conditions.
- D. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Comply with cold-weather construction requirements contained in Part 1.8 D. of ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

1.7 SPECIAL INSPECTIONS

- A. The Owner will engage the services of a qualified Special Inspector for this project. The Special Inspector will provide and/or coordinate inspection and testing requirements as necessary in accordance with the provisions of the Statement of Special Inspections Form contained in these Specifications.

PART 2 - PRODUCTS

2.1 BRICK

- A. General: Provide shapes indicated and as follows for each form of brick required:
 1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.
 2. Provide lipped brick at steel relieving angles as indicated on drawings.
- B. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 1. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view
- C. Face Brick: ASTM C 216, Grade SW, Type FBX, and as follows:
 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi.
 2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
 3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 4. Type: Extruded.
 5. Finish: Velour
 6. Size: Modular 3-5/8" x 2-1/4" x 7-5/8"
 7. Color and Texture: Cloud Ceramics "Browntweed"
 8. Application: Use where brick is exposed.

2.2 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color cement, except as indicated below.

1. For brickwork and cast stone, provide natural color or white cement as required to produce required mortar colors.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
- D. Masonry Cement: Not permitted.
- E. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
 1. For colored mortar, provide natural sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar colors.
- F. Aggregate for Grout: ASTM C 404.
- G. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars
- H. Water: Potable.

2.3 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.
- B. Stainless Steel Wire: ASTM A580/A580M, Type 304.
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
- D. Stainless Steel Bars: ASTM A276 or ASTM A666, Type 304

2.4 ANCHORS FOR CONNECTING TO CONCRETE

- A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 1. Anchor Section: Dovetail anchor section formed from minimum 0.0966-inch- (2.5-mm-) thick, stainless steel sheet.
 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.1875-inch- (4.8-mm-) stainless steel wire.
 3. Basis of Design Product: Hohmann & Barnard 305 Dovetail Slot with 315 Flexible Dovetail Brick Tie or one of the following, or equal:
 - a. 2102 Tie and 1304 Dovetail Slot by Wire Bond.
 - b. 103 Tie and 100 Dovetail Slot by Heckmann Building Products

2.5 ADJUSTABLE MASONRY-VENEER ANCHORS

- A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing or insulation to wood or metal studs, and as follows:
 - 1. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
- B. Screw-Attached, Masonry-Veneer Anchors for Metal Stud Back-up Construction: Units consisting of a wire tie section and a metal anchor section complying with the following requirements:
 - 1. Anchor Section: Rib-stiffened, sheet metal plate with 9/32" diameter screw holes top and bottom; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.
 - 2. Wire Tie Section: Rectangular- shaped wire tie sized to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.
 - 3. Fabricate sheet metal anchor sections and other sheet metal parts from 14 gauge (1.9 mm) thick, stainless steel sheet.
 - 4. Fabricate wire tie sections from 3/16 inch- (4.8-mm-) diameter, stainless steel wire.
 - 5. Basis of Design Product: HB-213; Hohmann & Barnard, Inc or one of the following or equal:
 - a. RJ-711; Wire-Bond.
 - b. #213 Anchor with #282 Tie; Heckmann Building Products
- C. Stainless-Steel Drill Screws for Steel Studs: Either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange by not less than three exposed threads
- D. Expansion Bolt-Attached, Masonry-Veneer Anchors for Existing Masonry or Concrete Back-up Construction (and where dovetail slots have not been installed in concrete): Units consisting of a wire tie section and a metal anchor section complying with the following requirements:
 - 1. Anchor Section: Rib-stiffened, sheet metal plate with 7/16" diameter bolt hole in the center for use with brass expansion bolt; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.
 - 2. Wire Tie Section: Rectangular- shaped wire tie sized to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.
 - 3. Fabricate sheet metal anchor sections and other sheet metal parts from 14 gauge (1.9-mm-) thick, steel sheet, hot-dip galvanized after fabrication.
 - 4. Fabricate wire tie sections from 3/16-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.
 - 5. Basis of Design Product: HB-5213 by Hohmann & Barnard, Inc. or comparable system/product by one of the following:
 - a. Wire-Bond

b. Heckmann Building Products (Pos-I-Tie system)

- E. Brass Expansion Bolt for Existing Masonry or Concrete Back-up Construction: Masonry fastener for fastening anchors to concrete, block, brick and into mortar joints complying with the following requirements:

1. Internal Bolt: 1/4" diameter – 20, Type 304 stainless steel.
2. Stainless Steel Washer: 3/4" OD, Type 18-8 stainless steel.
3. Knurled Expansion Sleeve and Expander Cone: Brass 260 alloy.
4. Fixture Clearance Hole: 7/16" diameter
5. ANSI Drill Bit Size: 3/8" diameter
6. Basis of Design Product: 523 Brass Expansion Bolt by Hohmann & Barnard, Inc. or equal system/product by one of the following:
 - a. Wire-Bond
 - b. Heckmann Building Products

2.6 MISCELLANEOUS ANCHORS

- A. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Type: Chemical anchors.
2. Type: Expansion anchors.
3. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.
4. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
5. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.7 EMBEDDED FLASHING MATERIALS

- A. Concealed Adhered Masonry Flashing: Provide rubberized sheet flashing overlapping a full bed depth stainless steel drip as follows:

1. Basis of Design Product: Provide specified product of Hohmann & Barnard or equal products by York or Wire-Bond.
2. Sheet-Metal Drip Flashing: Fabricate from 22 gage stainless steel with the drip edge hemmed approximately 3/16-inch and a 2 inch turn-up, as indicated on Drawings.
3. Self-Adhering Copper Fabric Laminated Sheet Flashing: Manufacturer's standard composite membrane consisting of a polyethylene film laminated to a 5 oz. copper sheet, with a pressure-sensitive, clear adhesive; non-asphaltic; Copper-Fabric SA Self-Adhering Copper Fabric Flashing by Hohmann & Barnard or equal. Verify compatibility with air barrier system that sheet flashing contacts.

- a. Primer: Flashing manufacturer's standard product or product recommended by flashing manufacturer for bonding flashing sheets to masonry and concrete; Primer – SA by Hohmann & Barnard or equal.
 - b. Termination Bar: Stainless steel.
- B. Metal Flashing: Provide metal flashing complying with Section 076200 "Sheet Metal Flashing and Trim" and as follows:
 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.
 2. Fabricate drip edge in one continuous length, 4 inches wide, with a hemmed outer edge condition held flush with face of finished masonry.
- C. Application: Unless otherwise indicated, use the following:
 1. Where flashing is indicated to receive counterflashing, use metal flashing.
 2. Where flashing is partly exposed and is indicated to terminate at the wall face, use concealed flexible flashing with a metal drip edge.
 3. Where flashing is fully concealed, use flexible flashing.

2.8 CAVITY-WALL INSULATION

- A. Extruded-Polystyrene Board Insulation (Drawing Designation Type 1A): ASTM C 578, Type X, 15-psi (104-kPa) minimum compressive strength, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. DiversiFoam Products; CertaFoam 15.
 - b. DuPont; Dow Styrofoam Brand Cavitymate.
 - c. Owens Corning; Foamular CW15 Square Edge.
 2. Thickness: As indicated on Drawings for each application.
 3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- B. Mechanical Fasteners: Type recommended by insulation board manufacturer for application indicated. Provide one of the following types, at Contractor's option:
 1. Impaling pins for mechanical attachment to back-up structure.
 2. Insulation fasteners system consisting of high density polyethylene fastener with zinc-coated steel pin, fastened to substrate with gas tool; Insulfast system by Ramset or equal.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

- C. Wicking Material: Absorbent rope, made from UV-resistant synthetic fiber, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity. Use only for weeps.
 - 1. Application: At cast stone sills, lintels and other locations as indicated.
- D. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe.
 - 1. Color: Match mortar color.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
 - a. WeepVent by Mortar Net Solutions.
 - b. CavClear Weep Vents.
 - c. Weep Mesh by Advanced Building Products
 - 3. Application: At brick veneer
- E. Cavity Drainage Material: 2-inch- (50-mm-) thick, reticulated, nonabsorbent mesh, made from polyethylene strands with 90% open plastic mesh configuration, and dovetail shape to maintain drainage at weep holes without being clogged by mortar droppings.
 - 1. Basis of Design Product: Provide one of the following or equivalent:
 - a. Mortar Net by Mortar Net Solutions
 - b. Mortar Trap by Hohmann & Barnard, Inc.
 - c. ProNet by Masonpro
- F. Cavity Drainage Material: 3/4-inch- (50-mm-) thick, reticulated, nonabsorbent mesh, made from polyethylene strands with 90% open plastic mesh configuration.
 - 1. Use in cavities with masonry back up and with less than 1-1/8" clear cavity only.
 - 2. Basis of Design Product: CavClear Masonry Mat manufactured by CavClear, or equivalent.

2.10 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.
- B. 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 cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Products for Cleaning Unit Masonry: Subject to compliance with requirements, provide one of the following products or equivalent products from alternative manufacturers:

- a. Cleaners for Red and Light-Colored Brick Not Subject to Metallic Staining with Mortar Not Subject to Bleaching: Sure Klean No. 600 Detergent; ProSoCo, Inc.
 - b. Cleaners for Red and Dark-Colored Brick Not Subject to Metallic Staining: Sure Klean No. 101 Lime Solvent; ProSoCo., Inc.
 - c. Cleaners for Brick Subject to Metallic Staining: Sure Klean Vana Trol; ProSoCo, Inc.
2. Alternative Manufacturers: Alternative manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
 - a. Diedrich Technologies Inc
 - b. Dominion Restoration, Inc.
 - c. EaCo Chem, Inc.

2.11 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.
- B. Colored Mortar for Brickwork and Cast Stone: Produce mortar of color specified, and to match approved mock-ups by using selected ingredients. Do not alter specified proportions without Architect's approval.
 1. Use naturally colored aggregates to produce required mortar color to greatest extent possible, before adding pigments.
 2. Pigments: Where mortar pigments are used, do not exceed a pigment-to-cement ratio of 1:10 by weight.
 3. Color: As selected by Architect
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.
 1. Limit cementitious materials in mortar to portland cement and lime.
 2. For masonry below grade, in contact with earth, and where indicated, use Type M.
 3. For exterior above-grade load-bearing and exterior above-grade non-load-bearing walls, interior load-bearing walls, parapet walls, and where indicated, use Type N.
 4. For brick units and stonework, use Type N.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 2. Verify that foundations are within tolerances specified.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

- A. For cold-weather construction comply with requirements contained in ACI-530/ASCE5/TMS 402.
- B. Thickness: Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.
- C. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.
- D. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.
- E. Cut masonry units with motor-driven saws to provide clean, sharp, un-chipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
1. Mix units from several pallets or cubes as they are placed.
- G. Wetting of Brick: Wet brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying

3.3 CONSTRUCTION TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
- B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.
- C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.

- D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, the following tolerances will apply.
 - 1. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m) or more.
 - 2. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch (9 mm) maximum.
 - 3. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.
 - 4. Variation in Plane between Adjacent Surfaces (Lipping): Do not exceed 1/16-inch (1.5-mm) difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.
- E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
- F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

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: Lay exposed masonry in bond pattern indicated below; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
 - 1. Running bond.
- C. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay solid brick-size 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.

1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.
- C. Collar Joints in Masonry: Fill the vertical, longitudinal joint between wythes solidly with grout for exterior walls noted, do not fill insulated cavity walls

3.6 CAVITIES

- A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.
 1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.
- B. Installing Cavity-Wall Insulation: Attach insulation to back-up substrate with impaling pins or insulation fasteners system applied in accordance with insulation manufacturer's directions. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Fasten units firmly against inside wythe of masonry or other construction as shown.
 1. Install each board with a minimum of 5 mechanically attached insulation fasteners, spaced in accordance with manufacturer's directions.
 2. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to concrete back-up or metal wall framing with masonry-veneer anchors to comply with the following requirements:
 1. Fasten each anchor section to concrete wall with two metal fasteners of type indicated.
 2. Fasten each anchor section through sheathing to metal wall framing with two metal fasteners of type indicated.
 3. Embed tie sections in masonry joints. Provide air space between back of masonry veneer and face of concrete wall as indicated on Drawings.
 4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 5. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 16 inches (406 mm) o.c. horizontally, with not less than 1 anchor for each 1.77 sq. ft. (0.16 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around the perimeter.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install vertical control and expansion joints at one side of all doorways and at wall locations maximum 25 ft. o.c., and where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form expansion joints in brick made from clay or shale by building in joint fillers not less than 1/2 inch (12.5 mm) for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants." Keep joint free and clear of mortar.
- C. Build in horizontal, pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants."
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

3.9 FLASHING, WEEP HOLES, AND VENTSFLASHING

- 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.
- B. 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.
- C. Install flashing as follows:
 - 1. At masonry-veneer walls, extend flexible flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge captured at a termination bar and sealed at top.
 - 2. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn flashing up not less than 2 inches to form end dams.
 - 3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge..
 - 4. Install end dams at all window and door flashing locations.
- D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:
 - 1. Use mesh weep vents to form weep holes at brick.
 - 2. Use wicking material to form weep holes above flashing under cast stone sills. Turn wicking down at lip of sill to be as inconspicuous as possible
 - 3. Space weep holes 24 inches (600 mm) o.c.
 - 4. Place cavity drainage material immediately above flashing in cavities.

- E. Install vents in vertical head joints at the top of each continuous cavity spaced at 24 inches o.c.. Use mesh weep vents to form vents.
- F. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.10 FIELD QUALITY CONTROL

- A. Inspectors: Owner will engage qualified certified testing agency to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
 - 1. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.
- C. Mortar Test (Property Specification): For each mix provided, per ASTM C 780 . Test mortar for mortar air content and compressive strength

3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.
- 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, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
 - 5. Clean brick masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04 2213

SECTION 04 7200 – CAST STONE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Cast stone sills, copings, trim, caps, and other shapes indicated on drawings.
2. Cast stone panels.
3. Cast stone structural lintels.
4. Steel and stainless steel support and retention connections for cast stone, including all ties, anchors, and necessary shims to supporting structure.
5. Engineered anchoring designs and connections, by a professional engineer employed by the Contractor.
6. Engineering of structural capability of lintels, by a professional engineer employed by the Contractor.

B. Related Sections:

1. Division 04 Section "Brick Masonry Veneer" for mortar and grout, and miscellaneous accessories.

1.2 DEFINITIONS

A. Cast Stone: Architectural precast concrete building units intended to simulate natural cut stone.

B. Arris: The sharp edge of a Cast Stone Unit.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Engineer, design, fabricate and erect the precast units and supports to withstand loads from winds, gravity, seismic, structural movement including movement thermally induced, and to resist in-service use conditions that the units will experience, including exposure to the weather, without failure.

1. Design each member to withstand stresses resulting from combinations of loads that produce the maximum allowable stresses in that member.
2. Design connection of precast units to structural backup. Refer to structural drawings and loads specified herein for minimum connection requirements.

B. Design Loads: Basic design loads include live loads, wind loads, and seismic load, in addition to the dead load.

1. Comply with requirements indicated on structural drawings.

1.4 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for cast stone units.
- B. Submit an Environmental Product Declaration (EPD) from the manufacturer for concrete and steel within this specification section, if available. A statement of the contractor's good faith effort to obtain the EPD shall be provided if not available.
 - 1. Manufacturer provided EPDs must be Product Specific Type III (Third Party Reviewed), in adherence with ISO 14025 Environmental labels and declarations, ISO 14044 Environmental management Life cycle assessment, and ISO 21930 Core rules for environmental product declarations of construction products and services.
- C. Design Mixes: For each different mix.
- D. Shop Drawings: Prepared by or under supervision of a qualified professional engineer. Detail fabrication and installation of cast stone units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement, and lifting devices necessary for handling and erection.
 - 1. Include building elevations showing layout of units and locations of joints and anchors
 - 2. Indicate locations and details of anchorage devices to be embedded in other construction.
 - 3. Include erection procedure for precast units, sequence of erection, and erection tolerances.
 - 4. Provide complete design calculations, including loads imposed on structure, stamped and signed by qualified professional engineer.
- E. Samples for Initial Selection: For colored mortar, showing the full range of colors available.
- F. Samples for Verification:
 - 1. For each mortar color required, showing the full range expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project. Label samples to indicate type and amount of colorant used.
 - 2. For each color and texture of cast stone required, 10-inches (250 mm) square in size.
- G. Full-Size Samples: For each type of cast stone unit required. Make available for Architect's review at Project site before installing cast stone.
 - 1. Approved Samples may be installed in the Work.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Fabricator and Professional Engineer.

- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of cast stone with requirements indicated.
- C. Certification that the materials incorporated in this Work are free from hazardous contaminants.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in manufacturing cast stone units similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to manufacture required units.
 - 1. Fabricator shall assume responsibility for engineering cast stone units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the location of the Project and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cast stone units that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. Source Limitations for Cast Stone: Obtain cast stone units through one source from a single manufacturer.
- E. 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.
- F. Mock-ups: Incorporate cast stone units in mock-up specified in Division 04 Section "Brick Masonry Veneer".

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship cast stone units in suitable packs or pallets.
 - 1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
 - 2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
- B. Store installation materials on elevated platforms, under cover, and in a dry location.

- C. Store mortar aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.8 COORDINATION

- A. Coordinate production and delivery of cast stone with unit masonry work to minimize the need for on-site storage and to avoid delaying the Work.
- B. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Provide products of Continental Cast Stone Manufacturing, Inc. or equal products manufactured by one of the following
 - 1. Arriscraft
 - 2. American ArtStone.
 - 3. Corinthian Cast Stone
 - 4. Stone Legends Inc.

2.2 CAST STONE MATERIALS

- A. General: Comply with ASTM C 1364 and the following:
- B. Portland Cement: ASTM C 150, Type I, containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation as needed to produce required textures.
- D. Fine Aggregates: Manufactured or natural sands complying with ASTM C 33, gradation as needed to produce required textures.
- E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
- F. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M.
 - 1. Epoxy Coating: ASTM A 775/A 775M.
 - 2. Galvanized Coating: ASTM A 767/A 767M.
- G. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 276 or ASTM A 666, Type 304.

2.3 STEEL SUPPORT AND CONNECTION MATERIALS

- A. Carbon-Steel Shapes: ASTM A 36. Steel shapes shall meet the requirements of ASTM A992 (50 ksi steel).
- B. Carbon-Steel Plate: Structural quality, hot-rolled carbon steel, ASTM A 283, Grade C.
- C. Electrodes for Welding: Comply with AWS code and ASTM A 232, E70XX Electrodes, Low Hydrogen.
- D. Finish: For exterior steel items, steel in exterior walls, exposed units, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M, after fabrication, and ASTM A 153/A 153M, as applicable. For inserts cast into precast units, provide hot-dipped galvanized, electrogalvanized, or cadmium coated finish. For all other items, provide shop painting with rust-inhibitive primer.

2.4 STAINLESS-STEEL SUPPORT AND CONNECTION MATERIALS

- A. Anchors: Stainless steel, ASTM A 666, Type 304, of temper and diameter required to support loads without exceeding allowable design stresses.
- B. Accessories: Provide clips, hangers, plastic shims, and other accessories required to install cast stone units.

2.5 CAST STONE UNITS

- A. Provide cast stone units complying with ASTM C 1364.
 - 1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364.
- B. Physical Properties:
 - 1. Compressive Strength: Minimum 6,500 psi when tested per ASTM C 1194.
 - 2. Absorption: Maximum 6% when tested per ASTM C 1195.
- C. Reinforce units as indicated and as required by ASTM C 1364. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches (38 mm) of material. Minimum coverage shall be twice the diameter of the bars.
 - 1. Area of reinforcement in panels greater than 12" wide shall be not less than 1/4 percent of the cross section area when steel is specified.
- D. Fabrication Method: Use a Vibrant-Tamp placement method or machine manufacture using a zero slump mixture to achieve desired appearance and physical properties.
- E. Fabricate units with sharp arris and details accurately reproduced with indicated texture on all exposed surfaces, unless otherwise indicated.
 - 1. Slope exposed horizontal surfaces at least 1:12, unless otherwise indicated.

2. Provide raised fillets at backs of sills and at ends indicated to be built into jams.
3. Provide drips on projecting elements, unless otherwise indicated.

F. Cure and finish units as follows:

1. Cure units in totally enclosed curing room under dense fog and water spray at 95 percent relative humidity for 24 hours.
2. Yard cure units until the sum of the mean daily temperatures for each day equals or exceeds 350 deg F.
3. Acid etch units to remove cement film from surfaces indicated to be finished.

G. Color and Texture: Exposed surfaces shall exhibit a fine-grained texture similar to natural stone; no bug-holes or air voids shall be permitted.

1. Color and Texture: Simulate buff limestone, in smooth texture, manufactured by Continental Cast Stone Manufacturing, Inc., or equal.

2.6 MORTAR MATERIALS

- A. Provide mortar materials that comply with Division 04 Section "Unit Masonry."

2.7 ACCESSORIES

- A. Anchors for Cast Stone Trim: Units fabricated with tabs or dowels designed to engage kerfs or holes in cast stone trim units and holes for fastening to framing of type as indicated, size as required for project conditions, fabricated from stainless steel complying with ASTM A 276 or ASTM A 666, Type 304.
- B. Dowels: Round stainless-steel bars complying with ASTM A 276, Type 304, 1/2-inch (12-mm) diameter.
- C. Weep Wicks: Provide products specified in Division 04 Section "Unit Masonry."
- D. Cast Stone Cleaner: Sure Kleen #600 by ProSoCo Products Inc., or equal.

2.8 MORTAR MIXES

- A. Provide ASTM C 270, Type N colored mortar. Comply with requirements in Division 04 Section "Unit Masonry" for mortar mixes.

2.9 SOURCE QUALITY CONTROL

- A. Employ an independent testing agency to sample and test cast stone units according to ASTM C 1364.
1. Include testing for freezing and thawing resistance.

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 cast stone.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with Cast Stone Institute recommendation for installation of cast stone units.
- B. Set cast stone as indicated on Contract Drawings. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
- C. Anchor cast stone panels in position by bolting, welding, grouting, or as otherwise indicated. Remove temporary shims, wedges, and spacers as soon as possible after anchoring and grouting are completed.
- D. Drench units with clear water just before setting.
- E. Set units in full bed of mortar with full head joints, unless otherwise indicated. Build anchors and ties into mortar joints as units are set.
 - 1. Fill dowel holes and anchor slots with mortar.
 - 2. Fill collar joint solid as units are set.
 - 3. Build concealed flashing into mortar joints as units are set.
 - 4. Leave head joints open in coping and other units with exposed horizontal surfaces. Keep joints clear of mortar, and rake out to receive sealant.
- F. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.
- G. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.
- H. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- I. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.
 - 1. Sealing joints is specified in Division 07 Section "Joint Sealants."
 - 2. Keep joints free of mortar and other rigid materials.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m) or more.
- B. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch (9 mm) maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.
- D. Variation in Plane between Adjacent Surfaces (Lipping): Do not exceed 1/16-inch (1.5-mm) difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.4 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. Remove mortar fins and smears before tooling joints.
- 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. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
 - 4. Clean cast stone in conformance cleaner manufacturer's directions.

END OF SECTION 04 7200

SECTION 05 1200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including general and supplementary conditions and Division 1 specification sections, apply to this section.
- B. Section 05 3000: Metal Deck, including field-installed shear connectors.

1.2 DESCRIPTION OF WORK

- A. This section includes structural steel.

1.3 QUALITY ASSURANCE

- A. Comply with latest editions of:
 - 1. American Institute of Steel Construction (AISC), "Manual of Steel Construction," including:
 - ANSI/AISC 360, "Specification for Structural Steel Buildings."
 - AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
 - Research Council on Structural Connections (RCSC), "Specification for Structural Joints Using High-Strength Bolts."
 - 2. American Welding Society, Inc. (AWS)
 - a. AWS D1.1 "Structural Welding Code - Steel."
 - b. AWS C5.4 "Recommended Practices for Stud Welding."
 - 3. Research Council on Structural Connections (RCSC), Educational Bulletin No. 4, "Recommended Erection and Field Inspection Procedures for High-Strength Bolts in Structural Steel Assemblies."
 - 4. American Hot-Dip Galvanizers Association, Inc.; Zinc Institute Inc.
 - a. "Inspection Manual for Hot-Dip Galvanized Products."
 - 5. Steel Structures Painting Council (SSPC)
 - a. "Surface Preparation Specifications."
- B. Qualifications for Welding Work:
 - 1. Qualify welding processes and welding operators in accordance with AWS standards.
 - 2. Provide one of the following certifications for welders to be employed in work.
 - a. Certification of satisfactorily passing AWS qualification tests within previous 12 months to perform type of welding in work.
 - b. Work record signed by supervisor showing regular employment within previous 12 months to perform type of welding in work.
- C. Qualifications for Fabricator, Detailer, and Erector:

1. Fabricator, Detailer, and Erector of structural steel shall have minimum 3 years experience in fabricating, detailing, and erecting structural steel.
 - a. Erector Qualifications: Erector shall be AISC Certified Erector, Category CSE.
 - b. Fabricator Qualifications: Fabricator shall be AISC Certified Fabricator, Category STD.
 - c. AISC Certification for Fabricators and Erectors may be waived at the discretion of Owner, Architect, and Engineer provided acceptable written quality assurance and quality control plan is submitted.
2. Submit written description of ability.
3. At completion of fabrication, Fabricator shall submit Certificate of Compliance to Special Inspector and Code Enforcement Official stating work was performed in accordance with approved Construction Documents in accordance with Chapter 17 of the *International Building Code* (IBC) as referenced by the *New York State Uniform Code*.

1.4 SPECIAL INSPECTIONS

- A. Refer to Specification Section 01 4533 and Schedule of Special Inspections.

1.5 MATERIAL EVALUATION/QUALITY CONTROL

- A. Contractor shall employ testing laboratory acceptable to Engineer and Architect to perform material evaluation tests.
- B. Submit testing service qualifications demonstrating experience with similar types of projects.
- C. The Registered Design Professionals (RDPs) for Structural Engineering and Architecture will visit construction site at appropriate intervals to determine if work is in general conformance with Contract Documents and specifications. Notify RDPs 48 hours before anticipated time of completion for a given section of work so they may determine if site observations are required. If site observations are required, do not conceal framing until RDPs have had opportunity to make observations.

1.6 SUBMITTALS

- A. General: Review of submittals will be for general conformance only. Compliance with requirements for materials, fabrication, erection, and dimensioning of structural steel shall be Contractor's responsibility. Resubmitted shop drawings shall have revisions identified and dated.
- B. Connections: Submit as follows:
 1. Submit proposed connection types and calculations for review before preparing detailed shop drawings.
 2. Submit connection calculations in accordance with Option 3 of AISC *Code of Standard Practice for Steel Buildings and Bridges*. Calculations shall be stamped

- by a licensed Professional Engineer in New York State (Connection Design Engineer) retained by Fabricator.
3. Connections shown on shop drawings shall be coordinated with the submitted connection calculations. Submit written confirmation from Fabricator's Connection Design Engineer that the shop and erection drawings accurately incorporate the connection designs.
- C. Shop Drawings: Submit detailed drawings showing:
1. Submit Shop Drawings showing details of each individual steel shipping piece.
 2. Submit Erection Drawings showing location and attachment of individual steel shipping pieces. Including field installation details in Erection Drawings.
 3. Reference Contract Drawing number and addendum number in each shop and Erection drawing.
 4. Shop and Erection drawings shall show:
 - a. Details including cuts, copes, camber, connections, holes, bolts, and other pertinent information.
 - b. Connection design loads.
 - c. Material, including ASTM designations and grades or manufacturer's data as appropriate.
 - d. Welds with size, length, and type.
 - e. Anchor rod locations.
 - f. Location of shop-welded masonry anchors and weldable reinforcement. Coordinate with Division 4 and Masonry Contractor.
 4. Shop and Erection drawings shall be checked by detailer and noted as checked in drawings before submitting. Failure to submit checked Shop and Erection drawings will be cause for their return without review. If drawings are not prepared by detailer under direct control of Fabricator, Fabricator shall stamp each drawing and initial or sign stamp to certify review and approval of drawings and conformance with Fabricator's shop practice and capability.
- D. Material Data: Submit to Special Inspector and Engineer laboratory test reports and other data as required to show compliance with specifications. Submit producer's or manufacturer's specifications and installation instructions for the following products:
1. Structural steel, including certified copies of mill reports covering chemical and physical properties.
 2. High-strength bolts, including nuts and washers.
 3. Unfinished bolts and nuts.
 4. Structural steel primer paint if used.
 5. Welding electrodes.
 6. Post-installed anchors (expansion, sleeve, or chemical adhesive) if used.
- E. Bolt Certification: Submit to Special Inspector and Engineer certifications that bolts, nuts, and washers furnished comply with specifications. Submit manufacturer's inspection certificates for mill tests. For fasteners to be accepted, lot numbers on kegs, boxes, or bags must correlate with lot numbers shown in accepted test certificates and identification numbers in mill test reports. Manufacturer's symbol and grade markings must appear on bolts and nuts.

- F. Field Modifications: Submit drawings showing field modifications required to conform to actual field conditions or as required to correct errors in shop drawings, fabrication, or erection.
- G. Erector's Welding Procedure Specifications: Submit welding procedure specifications for joint types detailed for field welding.
- H. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel within this specification section, if available. A statement of the contractor's good faith effort to obtain the EPD shall be provided if not available.
 - 1. Manufacturer provided EPDs must be Product Specific Type III (Third Party Reviewed), in adherence with ISO 14025 Environmental labels and declarations, ISO 14044 Environmental management Life cycle assessment, and ISO 21930 Core rules for environmental product declarations of construction products and services.

1.7 PRODUCT HANDLING

- A. Store material in horizontal position on supports above ground.
- B. Protect from weather, and keep free of dirt and debris.
- C. Handle material carefully so it is not bent or marred.
- D. Store bolted fastener components in closed containers protected from moisture and contamination. Remove from protective storage containers only number of fasteners required for one shift. Return fasteners not installed at end of work day to protective storage.
- E. Repair or replace damaged materials. Do not incorporate in work fastener components that accumulate rust or dirt.

1.8 WORKMANSHIP

- A. Contractor shall be responsible for correction of work not conforming to specified requirements. Correct deficient work as directed by Engineer.
- B. Remove work found to be defective. Replace with new acceptable work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials shall be new and free from rust.
- B. Rolled-Steel Plates and Bars: ASTM A 572, Grade 50.

- C. Rolled-Steel C, MC: ASTM A 992
- D. Rolled-Steel Angles, S, M, ST and MT Shapes: ASTM A 572, Grade 50.
- E. Rolled-Steel W and WT Shapes: ASTM A 992.
- F. Rolled-Steel HP Shapes: ASTM A572, Grade 50.
- G. Steel Pipe: ASTM A 53, Type E or S, Grade B.
- H. Hollow Structural Sections (HSS): ASTM A 500, Grade C.
- I. Stainless Steel Plates: ASTM A 276, Type 304 or 316; smooth finish.
- J. Stainless Steel Pipe: ASTM A 276, Type 304 or 316; or ASTM A 312, Grade TP304 or TP316; smooth finish.
- K. Unfinished Bolts, Nuts, and Washers: ASTM A 307, Grade A.
- L. High-Strength Bolts: ASTM A 325 or A 490, Type 1, plain.
- M. Twist-Off-Type, Tension-Control Bolt Assemblies: ASTM F1852 or ASTM F2280.
- N. High-Strength Bolts, Galvanized: ASTM A 325, Type 1.
- O. Anchor Rods: ASTM F 1554, Grade 36 or Grade 55 with Supplement S1, unless otherwise indicated in Drawings.
- O. Threaded Rods: ASTM A 36 unless otherwise indicated in Drawings.
- P. Nuts: ASTM A 563. Grade and finish to match bolt or rod type.
- Q. Washers: ASTM F 436 (ASTM F 844 for ASTM A 307 bolts, A 36 rods and F 1554 Grade 36 anchor rods). Finish to match bolt or rod type.
- R. Direct Tension Indicator Washers: ASTM F959 for use in pretensioned and slip-critical joints where direct-tension-indicator method is used. DTI "Squirter" as manufactured by Applied Bolting Technology or accepted equivalent.
- S. Electrodes: E70 and in accordance with AWS.
 - 1. E308 for Type 304 stainless steel.
 - 2. E316 for Type 316 stainless steel.
- T. Headed Stud Anchors: ASTM A 108, AWS Type B, minimum tensile strength 65 ksi, solid-fluxed and in accordance with AWS. Use arc shield (ferrule) with each anchor. Size as indicated in drawings.
- U. Nonshrink Grout: See section 03 3000

- V. Steel Primer Paint: For steel scheduled to receive finish paint, use primer compatible with finish paint specified in Division 9.
- W. Hot-Dip Galvanizing: Hot-dip galvanize after fabricating in accordance with ASTM A 123. Restraighten members after galvanizing if necessary to be square and true. Items to be hot-dip galvanized are identified in drawings.
- X. Cold-Galvanizing Compound: Zinc-rich, anti-corrosion paint complying with ASTM A780. "ZRC Cold Galvanizing Compound" by ZRC Worldwide; "Roval Cold Galvanizing Compound" by Roval Corporation; or accepted equivalent. Items to be cold galvanized are identified on the drawings.
- Y. Galvanizing Touch-up Compound: Zinc-rich, anti-corrosion paint complying with ASTM A780. "ZRC Galvilite" by ZRC Worldwide; "Roval ZC Galvanizing Repair" by Roval Corporation; or accepted equivalent. Use for field touch-up of hot-dip galvanized surfaces.
- Z. Below-Grade Coating: Coal-Tar Epoxy, "TNEMEC 46H-413" or accepted equivalent.
- AA. Expansion Anchors: "Kwik-Bolt-TZ" by Hilti or accepted equivalent. (ITW Ramset/Red Head, Powers Fasteners, Simpson/Strong-Tie; etc.)
- AB. Sleeve Anchors: "HLC Sleeve Anchor" by Hilti or accepted equivalent. (ITW Ramset/Red Head, Powers Fasteners, Simpson/Strong-Tie; etc.)
- AC. Screw Anchors: "Kwik HUS-EZ Screw Anchor" by Hilti or accepted equivalent (Tapcon, ITW Ramset/Red Head, Powers Fasteners, Simpson/Strong-Tie, etc).
- AD. Chemical Adhesive Anchors:
 - 1. Anchors to solid concrete:
 - a. Anchors for use when base material temperature is 0°F or greater: "HIT-Ice" by Hilti; or accepted equivalent.
 - b. Anchors for use when base material temperature is 40°F or greater; "HIT-HY 200 Safe Set System with HIT-Z Rod or Hollow Drill Bit System" or "HIT-RE 500-SD" by Hilti; or accepted equivalent.
 - 2. Anchors to hollow masonry (brick or hollow CMU), grouted CMU, solid brick, or stone:
 - a. Anchors for use when base material temperature is 40°F or greater: "HIT-HY 270" by Hilti; or accepted equivalent.
 - b. Provide manufacturer's standard screen tubes for use with anchors.
- AE. Weld-On Masonry Anchors: No. 317 continuous weld-on anchor rod by Heckmann Building Products for columns; No. 315 anchor rod for beams.
- AF. Furnish loose masonry anchors that are to be field-attached to structural steel by others. Provide No. 316 Triangular Ties and No. 318 Web Ties, size to suit wall, by Heckmann

Building Products.

- AG. Thermal Isolation Material (TIM): High-performance, fire-retardant, fiberglass-reinforced laminate composite for use between flanged connections of internal and external steelwork to limit thermal bridging, as manufactured by Fabreeka, Inc.; "Series 625 Extren" by Strongwell; or Type TBG300 by Farrat, Inc.; or accepted equivalent.
- AH. High-Strength Bolts, Stainless Steel: ASTM F 593, Alloy Group 1 Condition CW.
- AI. Stainless Steel Nuts: ASTM F 594, Alloy Group 1 Condition CW.

2.2 FABRICATION

- A. Fabricate structural steel in strict accordance with reviewed shop drawings and referenced standards.
- B. Fabricate and assemble structural material in shop to greatest extent possible.
- C. Fit stiffeners neatly between girder flanges. Where tight fits are required to transmit bearing, mill or grind ends of stiffeners for even bearing against flange.
- D. Provide camber as indicated in drawings. Where no camber is indicated, fabricate steel with mill camber up. Camber by mechanical means or by use of V-heat up to 1,200 degrees F maximum.
- E. Remove extension bars or runoff plates upon completing and cooling groove welds. Grind ends of welds smooth and flush with edges of abutting parts.
- F. Provide holes for securing other work to structural steel framing. Comply with AISC Specification 360, Section M2 for surface roughness for holes.
- G. For members to be hot-dip galvanized, comply with the American Galvanizer's Association Design Guide: The Design of Products to be Hot-Dip Galvanized After Fabrication.
- H. Unless shown otherwise in drawings, Fabricator shall detail column splice using AISC standard details. Finish ends of column shafts for direct bearing.
- I. Finish bottom of column and weld to base plate. Use flat base plates.
- J. For column base plates up to 24 inches, use 1/4-inch-thick, flat leveling plates unless noted otherwise in Drawings. For column bases over 24 inches, use leveling nuts and four anchor rods with heavy washers unless otherwise indicated in drawings.
- K. Anchor Rods: Furnish anchor rods, leveling plate, or other devices necessary for setting anchoring rods required for securing structural steel to foundation, concrete, or masonry.
- L. Steel Wall Framing: Select members true and straight for fabrication of steel wall framing and lintels. Straighten as required to provide uniform, square, and true members in

completed wall framing. Limit sweep to 1/8 inch for each 10 feet of length.

- M. Weld headed stud anchors with automatically timed, stud-welding equipment in accordance with ASW Specifications. Remove arc shields from studs after welding.
- N. Where headed stud anchors are to be welded to galvanized steel, Fabricator has the following options:
 - 1. Remove galvanized coating from surfaces to receive headed stud anchors prior to welding. Touch-up with cold-galvanizing paint after welding.
 - 2. Weld headed stud anchors to beams prior to galvanizing.

2.3 SHOP PAINTING

- A. Shop-paint structural steel work that will remain exposed to view in final work or where indicated in drawings. Do not paint members or portions of members to be concealed in final work embedded in concrete or mortar or to receive spray-on fireproofing unless noted otherwise in drawings.
- B. Do not paint the following surfaces:
 - 1. Surfaces within 2 inches of field welds.
 - 2. Surfaces within 1½ inches from center of slip-critical (SC) bolts or areas within bolt pattern.
 - 3. Top flanges of beams to receive field-installed shear connectors or weldable reinforcement. Coordinate locations with installers.
 - 4. Top and bottom flanges of beams to receive field-installed brace angles, shear wall connectors, or hybrid connectors. Coordinate locations with installers.
- C. Apply two coats of paint to surfaces that will be inaccessible after assembly or erection. Apply two coats to surfaces indicated to be cold-galvanized.
- D. For steel to be spray-fireproofed, clean steel to remove dirt, grease, rust, and loose mill scale in accordance with SSPC-SP3 "Power Tool Cleaning."
- E. For steel to be cold-galvanized or primed and finish-painted, clean steel to remove dirt, grease, rust, and loose mill scale in accordance with SSPC-SP6 "Commercial Blast Cleaning" unless recommended otherwise by paint manufacturer.
- F. For steel to be hot-dip galvanized, prepare steel by successive immersion in chemical baths of caustic cleaning, pickling, and flux.
- G. After surface preparation, immediately apply structural steel primer paint in accordance with manufacturer's instructions at rate to provide uniform dry-film thickness of 2 mils. Use painting methods that will result in full coverage of joints, corners, edges, and exposed surfaces.
- H. Apply coal-tar epoxy coating to steel below slab on grade and in contact with soil or subbase materials or as indicated in drawings. Extend coating 1 inch into slab.

2.4 CONNECTIONS

- A. Comply with requirements of this section unless indicated otherwise in drawings.
- B. A licensed Professional Engineer (Connection Design Engineer) shall be retained by Fabricator to design connections in accordance with Option 3 in *AISC Code of Standard Practice for Steel Building and Bridges*, for connections not detailed on the drawings.
- P. Use connection dimensions and sizes complying with AISC-published recommendations and limitations shown in drawings.
- Q. For shear connections, use only connections published in the *AISC Steel Construction Manual* without modification unless otherwise indicated in Drawings.
- R. Connections shown in the Drawings are representative details. Design connections to comply with the requirements and limitations as shown in the Drawings.
- S. Weld or bolt shop connections.
- G. Bolt field connections wherever possible.
- H. Minimum Capacity of Beam Connections: For connections not detailed, provide connection capacity for shear, axial, and moment reactions shown in drawings. If reactions are not shown in drawings, base on either Allowable Stress Design or Load and Resistance Factor Design as follows:
 - 1. Shear Connections:
 - a. At least 50 percent of uniform load from Maximum-Uniform Load Tables in *AISC Steel Construction Manual*, Part 3, for given steel member (ASD or LRFD, as appropriate).
 - b. At least 70 percent of uniform load from Maximum Uniform Load Tables in *AISC Steel Construction Manual*, Part 3, for beams and girders with shear connectors (ASD or LRFD, as appropriate).
 - c. Concentrated loads near supports must be added.
 - 2. Moment Connections:
 - a. Design moment connections for full bending capacity for given steel member.
- I. Beam connections to columns shall be in accordance with AISC and comply with the following.
 - 2. Use AISC Double-Angle Shear Connection for beam connections welded to faces of HSS columns having a workable flat of 6.75 inches or greater and to faces of W column flanges that have a width of 6.75 inches or greater, unless detailed otherwise on the drawings.

3. Use AISC Double-Angle Shear Connection for beam connections bolted to faces of W column flanges that have a width greater than 6 inches, unless detailed otherwise on the drawings.
 4. Use AISC Single-Plate Shear Connection for beam connections to faces of columns smaller than required for double-angle shear connection.
 5. AISC Seated Connections are permitted as an alternative to double-angle and single-plate shear connections.
- J. Use AISC Single-Plate, Single-Angle, Double-Angle, or End-Plate Shear Connection for beam-to-beam connections.
- K. Provide high-strength or unfinished threaded fasteners installed snug-tight for bolted bearing connections of secondary framing members to primary members including girts, door framing systems, and roof openings.
- L. Provide high-strength fasteners for principal bolted connections unless otherwise indicated.
- M. Fabricator shall provide connections to properly transmit total reactions, moments, and axial forces either indicated in drawings or reasonably inferred from information provided.
- N. Provide snug-tightened joints using bearing bolts with thread condition N for bolted connections unless indicated otherwise. Provide pretensioned or slip-critical joints where shown or noted in drawings. For slip-critical joints, provide AISC Class A faying surface condition.
- O. Remove burrs that prevent solid seating of connected parts.
- P. ASTM F1852 or F2280, twist-off-type, tension-control bolt assemblies may be used at snug-tightened. Compliance with RCSC Specifications for pre-installation testing and installation inspection is mandatory for the use of twist-off type, tension-controlled bolted connections, including pretensioned or slip-critical joints.

3.2 ERECTION

- A. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of a complete frame or structure before permanently fastening.
- B. Fit up connections to be field welded in compliance with AWS standard tolerances for review by the Special Inspector or Testing Agency prior to field welding.
- C. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact after assembly.
- D. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure within specified tolerances.

- E. Contractor may field modify anchor rods and embedded structural supports incorrectly located or damaged after installation as indicated in Section **033000** and tested by Testing Agency. Submit documentation showing proposed field modification for review and acceptance by Engineer before beginning.
- F. Splice members only where shown or specified.
- G. Maintain work in stable condition during erection.
- H. Erect masonry shelf angles connected to structural steel to approximate elevations shown in drawings. Weld after final adjustment is made by Masonry Contractor and before application of load. Coordinate with Division 4.
- I. Where weldable reinforcing bars are to be welded to structural steel members, coordinate installation of weldable reinforcement with Masonry Contractor.
- J. Install snug-tightened, pretensioned, and slip-critical bolted joints to comply with RCSC "Specification for Structural Joints Using High-Strength Bolts" and to comply with RCSC Educational Bulletin No. 4, "Recommended Erection and Field Inspection Procedures for High-Strength Bolts in Structural Steel Assemblies." Compliance with RCSC Specifications and Bulletins is mandatory for installation of all high-strength bolted connections including pretensioned or slip-critical joints.
- K. Install field connections and framing as detailed in Contract Documents and accepted shop drawings. If Contractor finds field modifications are necessary, submit documentation of proposed field modifications to Architect and Engineer for review and acceptance before beginning.
 - 1. Use of thermal cutting for field modifications is prohibited unless documented and accepted by Engineer before beginning.
 - 2. Use of thermal cutting for enlarging or cutting bolt holes in field is prohibited.

3.3 TOLERANCES

- A. Tolerances shall be within limits in AISC "Code of Standard Practice."
- B. Fabrication and mill tolerance shall be within limits in AISC "Standard Mill Practice."

3.4 TOUCH-UP PAINTING

- A. After erection is complete, touch up paint-damaged shop coats and welded areas with shop primer paint applied in accordance with manufacturer's instructions.
- B. Touch up paint damaged galvanized surfaces and welded areas with galvanizing touch-up compound or cold-galvanizing compound applied in accordance with manufacturer's instructions.
- C. Prepare surfaces of hot-dip galvanized members where the galvanization was omitted,

or damaged in accordance with SSPC-SP3 "Power Tool Cleaning." Prepare field-welded galvanized members similarly.

- D. Remove weld slag before applying touch-up paint.

3.5 TEMPORARY SHORING AND BRACING

- A. Provide temporary shoring and bracing members as required with connections of sufficient strength to bear imposed loads.
- B. Remove temporary members and connections when permanent members are in place and final connections are made.
- C. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

3.6 PROTECTION

- A. Do not use members for storage or work platforms until permanently secured.
- B. Do not exceed load capacity of members with construction loads.

3.7 WELDING TO EXISTING STEEL

- A. Clean area to be welded using mechanical grinders and solvents to remove paint, rust, and other materials.
- B. Use E7018, low-hydrogen electrodes stored in ovens as prescribed by AWS. Preheat steel to be welded and maintain temperatures as prescribed by AWS.

END OF SECTION 05 1200

SECTION 05 3000 - METAL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including general and supplementary conditions and Division 1 specification sections, apply to this section.
- B. Section 05 1200: Structural Steel.
- C. Section 03 3020: Concrete Slabs on Grade and Metal Deck.

1.2 DESCRIPTION OF WORK

- A. This section includes steel deck units for floor and roof applications.
- B. Header duct used in conjunction with cellular metal floor deck is specified in mechanical section.

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Comply with latest edition of:
 - 1. American Iron and Steel Institute (AISI) "Specification for the Design of Cold Formed Steel Structural Members."
 - 2. Steel Deck Institute (SDI).
 - a. "Design Manual for Composite Decks, Form Decks, and Roof Decks."
 - b. "Diaphragm Design Manual."
 - 3. American Welding Society Inc. (AWS).
 - a. AWS D1.1 "Structural Welding Code - Steel."
 - b. AWS D1.3 "Structural Welding Code - Sheet Steel."
 - c. AWS C5.4 "Recommended Practices for Stud Welding."
- B. Qualifications for Welding Work
 - 1. Use qualified welding processes and welding operators in accordance with AWS standards.
 - 2. Provide one of the following certifications for welders to be employed in work.
 - a. Certification of satisfactorily passing AWS qualification tests within previous 12 months to perform type of welding in work.
 - b. Work record signed by supervisor showing regular employment within previous 12 months to perform type of welding in work.
- C. Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory," with each deck unit bearing the UL label and marking for specific system detailed.

- D. FM Listing: Provide steel roof deck units that have been evaluated by Factory Mutual System and are listed in "Factory Mutual Approval Guide" for Class 1, fire-rated construction.

1.4 SPECIAL INSPECTIONS

- A. Refer to Specification Section 01 4533 and Schedule of Special Inspections.

1.5 MATERIAL EVALUATION/QUALITY CONTROL

- A. Preconstruction Testing: Contractor shall employ testing laboratory acceptable to Engineer and Architect to perform material evaluation tests.
- B. Submit testing service qualifications demonstrating experience with similar types of projects.
- C. See Part 3 Section "Shear Connectors" for testing of shear connector installation at the start of each day's production welding period and after welding equipment has been moved or changed. This testing is to be by the shear connector installer.
- D. Contractor shall secure services of company field advisor from manufacturer of powder-actuated or pneumatically driven fasteners used to anchor metal deck. Field advisor shall be certified in writing by manufacturer to be technically qualified in product installation. Personnel involved solely in sales do not qualify. Field advisor shall be present at beginning of installation of product and as required during duration of project to:
 - 1. Render technical assistance to Contractor regarding installation procedures of product to satisfy warrantee or guarantee requirements.
 - 2. Provide specialized training in use of product to Contractor's personnel.
 - 3. Verify correct fastener is being used for each structural substrate type and thickness.
 - 4. Verify proper tools and application procedures.
 - 5. Familiarize Contractor/Owner/Architect/Engineer with entire system, including inspection techniques.
 - 6. Answer questions that arise.
- E. Field advisor shall prepare a written report summarizing information listed above. Submit report to Special Inspector, Contractor, Owner, Architect, and Engineer.
- F. Contractor shall be responsible for expenses of field advisor and verifying credentials of advisor.
- G. The Registered Design Professionals (RDPs) for Structural Engineering and Architecture will visit construction site at appropriate intervals to determine if work is in general conformance with Contract Documents and specifications. Notify the RDPs 48 hours before anticipated time of completion for given section of work so that they may determine if site observations are required. If site observations are required, do not conceal metal deck or place concrete slabs until the RDPs have had opportunity to make observations.

1.6 SUBMITTALS

- A. General: Review of submittals is for general conformance only. Compliance with requirements for materials, fabricating, erection, and dimensions is Contractor's responsibility.
- B. Shop Drawings: Submit detailed drawings showing:
 - 1. Reference Contract Drawing number including addendum number in each shop drawing.
 - 2. Panel layout.
 - 3. Anchorage details showing locations and size of welds or mechanical fasteners if used.
 - 4. Each condition requiring closure panels.
 - 5. Location and attachment of accessories.
 - 6. Supplementary framing furnished and required.
 - 7. Special conditions; opening locations.
 - 8. Side-lap fastening.
 - 9. Material thickness.
 - 10. Deck finish.
 - 11. Cross-section of panel with dimensions.
 - 12. Layout, size, material, and quantity of shear connectors.
 - 13. Panels requiring shoring from panel layout.
 - 14. Powder-actuated corrosion resistant fasteners.
- C. Calculations: Submit calculations for powder-actuated fasteners indicating required diaphragm capacity has been provided in accordance with the Performance Requirements section of this Specification and the Drawings.
- D. Manufacturer's Data: Submit to Special Inspector and Engineer laboratory test reports and other data as required to show compliance with specifications. Submit producer's or manufacturer's specifications and installation instructions for the following products:
 - 1. Sheet steel deck, including certified copies of mill reports covering chemical and physical properties.
 - 2. Shop primer paint if used.
 - 3. Welding electrodes.
 - 4. Mechanical and side-lap fasteners.
 - 5. Shear connectors.
- E. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel within this specification section, if available. A statement of the contractor's good faith effort to obtain the EPD shall be provided if not available.
 - 1. Manufacturer provided EPDs must be Product Specific Type III (Third Party Reviewed), in adherence with ISO 14025 Environmental labels and declarations, ISO 14044 Environmental management Life cycle assessment, and ISO 21930 Core rules for environmental product declarations of construction products and services.

1.7 PERFORMANCE REQUIREMENTS

- A. See drawings.

1.8 PRODUCT HANDLING

- A. Store materials in approximately horizontal position on supports above ground with one end elevated for drainage.
- B. Protect from weather, and keep free of dirt and debris.
- C. Ventilate to avoid condensation.
- D. Handle material carefully so it is not bent or marred.
- E. Replace damaged materials at no cost to Owner.

1.9 WORKMANSHIP

- A. Contractor shall be responsible for correction of work not conforming to specified requirements. Correct deficient work as directed by Architect.
- B. Remove work found to be defective. Replace with new acceptable work.

PART 2 - PRODUCTS

2.1 DECK MATERIALS

- A. Materials shall be new and free from rust.
- B. Uncoated or Painted (Shop-primed) Steel Deck: ASTM A 1008 with a minimum 40,000 psi yield strength.
- C. Galvanized Steel Deck: ASTM A 653, with galvanized coating Designation G 60. Minimum 40,000 psi yield strength.
- D. Galvanized and Painted (Shop-primed) Steel Deck: ASTM A 653, with galvanized coating Designation G 60, extra smooth, with no oil preservatives. Cleaned and phosphatized, with one coat of shop primer. Areas of metal deck to be galvanized and shop primed are indicated in the drawings. Minimum 40,000 psi yield strength.
- E. Roof Deck Units:
 - 1. Type: "B or N" by Canam, Vulcraft, Consolidated System, Inc., New Millennium, or accepted equivalent.
 - 2. Size: As shown in drawings.
 - 3. Finish: Galvanized unless noted otherwise in drawings.
- F. Composite Floor Deck Units:

1. Type: "B-Lok or Lok-Floor" by Canam; "VL" by Vulcraft; "Composite Floor-Dek" by Consolidated System, Inc.; "CD Deck" by New Millennium; or accepted equivalent.
2. Size: As shown in drawings.
3. Finish: Galvanized unless noted otherwise in drawings.
4. Provide deck units with integral embossing or raised pattern to furnish mechanical bond with concrete slabs. Open-beam deck units shall have fluted section with interlocking side laps.

G. Non-Composite Steel Form Deck:

1. Type: "UFS" by Canam; "C" by Vulcraft; "S-Dek or HD-Dek" by Consolidated System, Inc.; "FD" by New Millennium; or accepted equivalent.
2. Size: As shown in drawings.
3. Finish: Galvanized unless noted otherwise in drawings.

2.2. ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Structural Shapes, Bars, and Plates: ASTM A 36. Refer to Section 051200.
- C. Shear Connectors: Headed stud-type, 3/4-inch-diameter, ASTM A 108 Grades 1010 through 1020, solid fluxed and in accordance with AWS. Provide Type B studs having a minimum yield strength of 50,000 psi, in accordance with AWS D1.1. An arc shield (ferrule) shall be used with each connector. Provide shear connections meeting the following size criteria unless noted otherwise in Drawings:
1. Minimum of 3 inches long.
 2. Lengths to provide a minimum of 1 inch concrete cover over top of connectors.
 3. Connector to project a minimum of 1 1/2 inches above top of deck.
- D. Electrodes: In accordance with AWS.
- E. Welding Washers: As required by deck manufacturer.
- F. Mechanical Fasteners: Corrosion-resistant, low-velocity, powder-actuated, or pneumatically driven carbon steel fasteners or self-tapping screws.
1. "X-ENP-19 L15" or "X-HSN-24" powder-actuated fasteners by Hilti, or accepted equivalent.
- G. Sidelap Fasteners: Corrosion-resistance, hexagonal washer head: self-tapping, carbon steel screws. No. 10 minimum diameter.
- H. Sheet Metal Accessories: ASTM A 653, SS Grade 33, commercial-quality steel sheets with G 60 galvanized coating.

1. Pour stops and Girder Fillers: Provide 16-gauge-minimum thickness unless noted otherwise.
 2. Metal Cover Plates: Not less than thickness of deck.
 3. Metal Cell Closures: Provide 18-gauge-minimum (0.045-inch) thickness.
 4. Roof Sump Pans: Provide 14-gauge-minimum (0.0747) thickness.
 5. Provide 20-gauge-minimum thickness for other accessories unless noted otherwise.
- I. Flexible Cell Closures: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.
- J. Acoustic Sound Barrier Closures: Manufacturer's standard mineral-fiber closures.
- K. Shop Primer Paint: For application to metal surfaces chemically cleaned and phosphate chemical treated.
1. "Valspar Low Cure Epoxy 88107-7197", "Akzo Noble 9X4444", or accepted equivalent.
 2. Comply with the adhesion performance requirements of ASTM D 3359, Methods A and B with a 5A rating.
- L. Touch-up Material:
1. Galvanizing Touch-up Compound: "ZRC Galvilite" by ZRC Worldwide; "Roval ZC Galvanizing Repair" by Roval Corporation; or accepted equivalent. Use for field touch-up of galvanized sheet metal.
 2. Steel Primer Paint: Use primer compatible with finish paint specified in Division 9 for repair of painted surfaces.

2.3 FABRICATION

- A. General: Form deck units in lengths to span three or more supports.
1. Provide flush or 2-inch nested end laps for roof deck, except at joists provide 4-inch nested end laps.
 2. Provide flush end laps for floor deck and floor form deck.
 3. Use nested side laps.
 4. Prior to shipping decking to job site, manufacturer shall wire-brush, grind, clean, and paint scarred areas (weld marks on cellular deck, scratches, rust spots, etc.) on top and bottom surfaces of decking units.
 - a. Touch up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.
 - b. Touch up painted surfaces with shop primer paint applied in accordance with manufacturer's instructions.
 - c. Galvanized and painted steel deck shall be first touched up with galvanizing repair paint. After paint has cured, touch up with shop primer paint.
 - d. Unrepaired scarred areas will be evaluated by Architect and may be cause for rejection of deck units.
- B. Acoustic Deck Units:

1. Fabricate single-pan fluted units with vertical webs perforated with approximate 5/32-inch-diameter holes staggered 3/8 inch on center. Provide mineral-fiber acoustical insulation strips of profile to fit void space between vertical ribs.
 2. Fabricate multiple-pan cellular units with upper fluted section combined with lower flat plate section having interlocking side laps and approximate 5/32-inch-perforations staggered on 3/8 inch centers under cells formed by upper unit. Provide manufacturer's mineral-fiber acoustical insulation strips of profile to fit void space of each cell.
- C. Metal Cover Plates: Fabricate metal cover plates for end-abutting floor deck units. Form to match contour of deck units and approximately 6 inches wide.
- D. Metal Cell Closures: Fabricate metal closure strips for cell raceways and openings between decking and other construction. Form to provide tight-fitting closures at open ends of cells or flutes and sides of decking.
- E. Roof Sump Pans: Fabricate from single piece of sheet steel with level bottoms and sloping sides to direct water flow to drain. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3 inches wide. Recess pans not less than 1½ inches below roof deck surface unless otherwise shown or required by deck configuration. Holes for drain will be field cut by others.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Examine conditions under which work shall be erected. Do not proceed until unsatisfactory conditions are corrected.

3.2 ERECTION

- A. General: Install deck and accessories in accordance with manufacturer's recommendations, and accepted shop drawings.
- B. Cut and fit units and accessories around projections through decking. Make cuts neat and square.
- C. Do not use cutting torches.
- D. Position deck on supporting steel framework and adjust to final position with ends bearing a minimum of 2 inches on supporting members and accurately aligned end to end before being permanently fastened.
- E. Do not install deck in a single span condition unless noted otherwise in Drawings. Lay out deck to provide a minimum two-span condition. Notify Engineer if single span deck is required.
- F. Do not stretch or contract side-lap interlocks.

- G. Align deck units for entire length of run of cells and with close alignment between cells at ends of abutting units.
- H. Place deck units flat and square, secured to adjacent framing without warp or deflection.
- I. At beams to receive shear connectors and pour stops, lap pour stop 2 inches onto beam flange and butt deck to pour stop. Do not lap deck onto pour stop. Locate shear connectors on the opposite side of the beam flange from pour stop.
- J. Do not place deck units on concrete supporting structure until concrete has cured and dried.
- K. Coordinate and cooperate with structural steel erector in locating deck bundles to prevent overloading of structural members.
- L. Fastening Deck Units:
 - 1. Fasten floor deck units to steel supporting members to resist forces listed under Performance Requirements. Minimum fastening shall be by nominal 5/8-inch-diameter puddle welds or elongated welds of equal strength, spaced not more than 12 inches on center with minimum of three welds a unit at each support.
 - 2. Fasten roof deck units to steel supporting members to resist forces listed in drawings or under performance requirements. Minimum fastening shall be by nominal 5/8-inch-diameter puddle welds or elongated welds of equal strength, spaced not more than 12 inches at every support and closer where indicated. In addition, secure deck to each supporting member in ribs where side laps occur.
 - 3. Comply with AWS requirements and procedures for manual shielded metal arc-welding, appearance and quality of welds, and methods used in correcting welding work.
 - a. Use welding washers where recommended by deck manufacturer.
 - 4. Mechanical fasteners may be used in lieu of welding. Locate fasteners and install in accordance with the manufacturer's accepted submittal.
 - 5. Mechanically fasten side laps of adjacent deck units between supports at intervals not exceeding 36 inches on center using No. 10 or larger self-tapping screws unless otherwise specified by manufacturer. Button punching not permitted.
 - 6. Keep the interiors of cells that will be used as raceways free of welds having sharp points or edges.
- M. Pour Stops and Girder Fillers: Install pour stops and girder fillers at edges of slabs and in voids between decking and other construction.
 - 1. Weld pour stops and girder fillers at 6 inches on center. Butt joints tight and weld top and bottom.
- N. Cell closures: Install metal cell closures at open uncovered ends and edges of decking to provide complete decking installation.

1. Fasten using tack weld or install No. 10 or larger self-tapping screws at 4 feet on center.
 2. At Contractor's option, provide flexible cell closures instead of metal cell closures wherever their use will ensure complete closure. Install with adhesive in accordance with manufacturer's instructions.
- O. Hanger Slots or Clips: Provide UL-approved punched hanger slots between cells or flutes of lower element where floor deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures.
1. Hanger clips designed to clip over male side lap joints of floor deck units may be used instead of hanger slots.
 2. Locate slots or clips at not more than 14 inches on center in both directions, not over 9 inches from walls at ends, and not more than 12 inches from walls at sides unless otherwise indicated.
 3. Provide manufacturer's standard hanger attachment devices.
- P. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units except where taped joints are required.
- Q. Roof Sump Pans: Place over openings provided in roof decking and weld to top decking surface. Space welds not more than 12 inches on center with at least one weld at each corner.
- R. Ridge and Valley Plates: Weld ridge and valley plates to top surface of roof decking.
1. Lap end joints not less than 3 inches with laps in direction of water flow.

3.3 DECK REINFORCEMENT

- A. Unless noted otherwise, reinforce roof deck as follows:
1. For deck openings less than 15 inches wide and not supported by structural members, fabricate from minimum 18-gauge, galvanized sheet metal. Fusion-weld to bottom surface of deck and extend at least 12 inches wider and longer than opening. Weld at each corner, and provide two welds to each rib crossed. Weld edges parallel with deck at 12 inches on center.
 2. For deck openings from 15 inches to 30 inches wide and not supported by structural members, weld 2-inch x 2-inch x 1/4-inch steel angle to underside of deck at right angles to deck ribs. Extend angles three ribs beyond each side of opening and puddle weld. Reinforce side of opening parallel to ribs with 18-gauge sheet metal 12 inches wide placed on bottom surface of decking. Weld plate at each corner and at 12 inches on center along edges.
 3. For deck openings greater than 30 inches wide, provide structural steel for edge support around entire opening. Frame into adjacent structural members.
 4. For sleeved penetrations smaller than rib width, no reinforcing is required.
- B. Unless noted otherwise, reinforce composite floor deck as follows:

1. For deck openings up to 24 inches wide and not supported by structural members, provide additional two, No. 5 bar slab reinforcing each side of openings as shown in drawings.
2. For deck openings greater than 24 inches wide, provide structural steel for edge support around entire opening, except where a side is within 12 inches of another framing member. Frame into adjacent structural members.
3. For sleeved penetrations smaller than rib width, no reinforcing is required.
4. At openings in composite decks not supported by structural members, form openings in slab, but do not cut deck until slab strength reaches 75 percent of its design strength or until needed by trade requiring the opening.

C. Unless noted otherwise, reinforce floor form deck as follows:

1. For deck openings up to 15 inches wide and not supported by structural members, provide additional slab reinforcing, two No. 5 bars each side of openings, as shown in the drawings.
2. For deck openings greater than 15 inches wide, provide structural steel for edge support around entire opening. Frame into adjacent structural members.
3. For sleeved penetrations which are smaller than rib width, no reinforcing is required.

3.4 SHEAR CONNECTORS

- A. General: Installation shall be in accordance with AWS Code, using automatically timed connector welding equipment.
- B. Clean welding surface before installing connectors.
- C. Lay out shear connectors prior to welding.
- D. For beams perpendicular to deck span, distribute shear connectors as follows unless noted otherwise:
1. Equally space (approximately) connectors in one row along beam at a maximum spacing of 2 feet on center. Notify Engineer if there are insufficient connectors to space at 2 feet on center throughout the length of the beam.
 2. If there are connectors remaining, assign one connector to every other rib without a connector starting at each end of beam.
 3. If there are still connectors remaining, assign one connector to each rib without a connector, again starting at each end of beam.
 4. If number of connectors exceeds number of ribs, assign one connector to each rib. Assign a second connector to each rib starting at each end of beam until all connectors are used. Weld connectors only after assigning is completed.
 5. Do not center connectors in ribs with rib stiffeners. Offset connectors to the side of each rib closest to the nearest beam end.
- E. For beams parallel to deck span, distribute shear connectors as follows unless noted otherwise:

1. Equally space total number of connectors in one row along beam.
 2. Connector spacing along beam shall not be closer than 4 1/2 inches on center.
 3. For one row of connectors, locate connectors over beam web. For two rows of connectors, locate each row 1 1/2 inches from center of beam web (3 inch gauge).
- F. At start of each day's production welding period and after welding equipment has been moved or changed, weld and test two test connectors. These connectors shall be bent to an angle of 30 degrees from vertical by striking with a hammer. If failure occurs in weld zone of either connector, correct or adjust welding operation. Two consecutive connectors shall be welded and found satisfactory before production welding can begin.
1. Where connectors are welded through metal deck, ten connectors shall be tested as described above. Connectors shall be on the same beam and through the same deck type and thickness. Ten consecutive connectors shall be welded and found satisfactory before production welding can begin.
 2. Connector tests shall be performed each time conditions change (i.e., no deck to through deck, through one thickness or layer of deck to another thickness or multiple layers of deck, change of deck types).
- G. Replace connectors that fail inspection by Testing/Inspecting Agency at no expense to Owner.
- H. Break ferrules away from connectors.
- I. Do not weld when air temperature is below 0 degrees F or when welding surface is wet.
- J. Beam top flange shall not be painted or galvanized in area of connector welding. Remove paint, galvanized coating, rust, and debris prior to welding connectors.
- K. Number of shear connectors shown in drawings is based on deck type and size specified. Should deck be installed with characteristics different than specified deck, number of shear connectors shall be increased to provide equivalent capacity at no additional expense to Owner.

3.5 SHORING

- A. If noted on the drawings, during concrete installation, provide shoring in accordance with manufacturer's requirements for deck gauge and span. Maintain shoring until concrete has achieved design strength.

3.6 TOUCH-UP PAINTING

- A. After installing decking, wire-brush, clean, and paint scarred areas (scratches, weld burn marks, etc.), welds (shop and field), and rust spots on top and bottom surfaces of decking units and supporting steel members.
1. Touch-up paint damaged galvanized surfaces and welded areas with galvanizing touch-up compound applied in accordance with manufacturer's instructions.

2. Touch-up paint damaged shop priming coats with shop primer paint applied in accordance with manufacturer's instructions.
 3. Galvanized and painted steel deck shall be first touched up with galvanizing touch-up compound. After paint has cured, touch up with shop primer paint.
- B. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

3.7 PROTECTION AND LOADING

- A. Do not use units for storage or for work platforms until deck is permanently secured to the supporting structure.
- B. Do not exceed load capacity of deck with construction loads. Limit temporary construction loads to 20 psf.
- C. Before concrete placement, check welds. Reweld broken or damaged welds.
- D. Do not suspend mechanical, electrical, or plumbing items from roof or floor form deck. Suspend loads directly from main framing or from supplemental framing installed between main framing.
1. Refer to mechanical, electrical, and plumbing specifications for hangers and supplemental framing required to attach these items to main framing.

3.8 TOLERANCES

- A. Maximum variation in deck unit alignment shall be 1/4 inch in 40 feet.

END OF SECTION 05 3000

SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including general and supplementary conditions and Division 1 specification sections, apply to this section.
- B. Section 05 5000 "Metal Fabrications" for masonry shelf angles and connections.
- C. Section 09 2116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.
- D. Section 09 2216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.2 DESCRIPTION OF WORK

- A. This section includes the following types of cold-formed metal framing:

- 1. Exterior load-bearing wall framing.
- 2. Interior load-bearing wall framing.
- 3. Exterior non-load-bearing wall framing.
- 4. Floor joist framing.
- 5. Roof rafter framing.
- 6. Ceiling joist framing.
- 7. Soffit framing.
- 8. Manufacturer's accessories.

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Comply with latest editions of:

- 1. AISI S100 "North American Specification for the Design of Cold-Formed Steel Structural Members".
- 2. AISI S200 "North American Standard for Cold-Formed Steel Framing – General Provisions".
- 3. AISI S201 "North American Standard for Cold-Formed Steel Framing – Product Standard".
- 4. AISI S210 "North American Standard for Cold-Formed Steel Framing – Floor and Roof System Design".
- 5. AISI S211 "North American Standard for Cold-Formed Steel Framing – Wall Stud Design".
- 6. AISI S212 "North American Standard for Cold-Formed Steel Framing – Header Design".
- 7. AISI S213 "North American Standard for Cold-Formed Steel Framing – Lateral Design".

8. AISI "Code of Standard Practice for Cold-Formed Steel Structural Framing".
 9. American Welding Society, Inc. (AWS): AWS D1.1 "Structural Welding Code - Steel" and AWS D1.3 "Structural Welding Code - Sheet Steel."
 10. American Society for Testing and Materials (ASTM):
 - a. ASTM C 1007 "Standard Specification for Installation of Load-Bearing (Transverse and Axial) Steel Studs and Related Accessories."
 - b. ASTM A653 / A653M – 09a "Standard Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process."
 - c. ASTM A780 / A780M - 09 "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings."
- B. Qualifications for Welding Work:
1. Qualify welding processes and welding operators in accordance with AWS standards.
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 2. Provide one of the following certifications for welders to be employed in the work:
 - a. Certification of satisfactorily passing AWS qualification tests within previous 12 months to perform type of welding in work.
 - b. Work record signed by supervisor showing regular employment within previous 12 months to perform type of welding in work.
- C. Qualifications for Fabricator and Installer:
1. Installer of cold-formed metal framing shall have minimum 3-years experience in installation of cold-formed metal framing on projects similar in material, design, and size to this project.
 2. Submit written description of ability.
- D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 for testing indicated.
- E. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- F. Fire-Rated Assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating including those required for compliance with governing regulations, provide units that have been approved by governing authorities having jurisdiction.
- G. Preinstallation Conference: Prior to start of installation of metal framing systems, meet at project site with installers of other work, including structural steel, door and window frames, mechanical, and electrical work. Review areas of potential interference and conflicts. Coordinate layout and support provisions for interfacing work.

1.4 SPECIAL INSPECTIONS

- A. Refer to Specification Section 01 4533 and the Schedule of Special Inspections.

1.5 MATERIAL EVALUATION/QUALITY CONTROL

- A. Preconstruction Testing: Contractor shall employ a testing laboratory acceptable to Engineer and Architect to perform material evaluation tests.
- B. Submit testing service qualifications demonstrating experience with similar types of projects.
- C. The Registered Design Professionals (RDPs) for Structural Engineering and Architecture will visit the construction site at appropriate intervals to determine if work is in general conformance with Contract Documents and specifications. Notify RDPs 48 hours before anticipated time of completion for a given section of work so they may determine if site observations are required. If site observations are required, do not conceal framing until RDPs have had an opportunity to make observations.

1.6 SUBMITTALS

- A. Shop Drawings: Submit detailed drawings showing:
 - 1. Reference Contract Drawing number and addendum number in each shop drawing.
 - 2. Cold Formed Metal Wall and Floor/Roof Framing:
 - a. Include complete layout of framing, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Provide building elevations showing framing layout including shop-fabricated panels.
 - b. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, bridging anchorage for axial load bearing studs, splices, accessories, connection details, and attachment to adjoining work.
- B. Material Data: Submit to Special Inspector and Engineer laboratory test reports and other data as required to show compliance with specifications based on evaluation of comprehensive tests for current products. Submit producer's or manufacturer's specifications and installation instructions for the following:
 - 1. Product data and installation instructions for each item of cold-formed metal framing and accessories, including manufacturer's suggested capacities and certified test data.
 - 2. Mill certificates signed by steel sheet producer or test reports from qualified independent Testing Agency indicating steel sheet complies with specified requirements.
 - 3. Certification that framing members have equivalent or greater capacities and properties than specified performance requirements.

4. Welding certificates and electrodes.
 5. Product data for screws, bolts, and other fasteners used.
 6. Post-installed anchors (expansion, sleeve, or chemical adhesive) if used.
 7. Mechanical fasteners.
 8. Vertical deflection clips.
 9. Horizontal drift deflection clips.
 10. Miscellaneous structural clips and accessories.
 11. Research reports: For non-standard cold-formed steel framing, from ICC-ES.
- C. Qualification Data: Submit to Special Inspector and Engineer data for firms and persons specified in "Quality Assurance" paragraph to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
- D. Coordination Drawings: Submit plans, elevations, sections, and details illustrating interface and anchorage of manufactured wall panels to cold-formed metal framing system.
- E. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel within this specification section, if available. A statement of the contractor's good faith effort to obtain the EPD shall be provided if not available.
1. Manufacturer provided EPDs must be Product Specific Type III (Third Party Reviewed), in adherence with ISO 14025 Environmental labels and declarations, ISO 14044 Environmental management Life cycle assessment, and ISO 21930 Core rules for environmental product declarations of construction products and services.

1.7 PERFORMANCE REQUIREMENTS

- A. 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.

1.8 PRODUCT HANDLING

- A. Store materials in approximately horizontal position on supports above ground with one end elevated for drainage.
- B. Protect from weather, and keep free of dirt and debris.
- C. Ventilate to avoid condensation.
- D. Handle material carefully so it is not bent or marred.
- E. Replace damaged materials at no cost to Owner.

1.9 WORKMANSHIP

- A. Contractor shall be responsible for correction of work not conforming to specified requirements. Correct deficient work as directed by Architect.
- B. Remove work found to be defective. Replace with new acceptable work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: Provide galvanized finish to metal framing components complying with ASTM A 653 for minimum G60 coating. Provide minimum G90 coating for exposed exterior environments.
- B. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: 50.
 - 2. Coating: G60 (Z180).
- C. Load Bearing Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch - 43 mil (18Ga)
 - 2. Flange Width: 1-5/8 inch minimum.
 - 3. Section Properties: See drawings.
- D. Non-Load Bearing Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch - 43 mil (18Ga).
 - 2. Flange Width: 1-5/8 inch minimum.
 - 3. Section Properties: See Drawings.
- E. 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: 0.0428 inch - 43 mil (18Ga), unless thicker material is required by structural performance, .
 - 2. Flange Width: 1-1/4 inch minimum.
 - 3. Top and Bottom Tracks of Load Bearing Walls shall be "SigmaTrak" by The SteelNetwork or accepted equal.

- F. Load Bearing 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: 0.0538 inch - 54 mil (16 Ga).
 2. Flange Width: 1-5/8 inches (41 mm) minimum.
 3. Section Properties: See drawings.
- G. Wall Bridging:
1. Channel Bridging Inside Wall: 1-1/2 inch web, 1/2 inch flanges, 0.0342 inch uncoated thickness and G-90 hot-dipped galvanized coating according to ASTM A 123/A 123M. Attach to studs as required by structural design calculations.
 2. Flat Strap: Width and thickness as required by structural design calculations.
 3. Solid Bridging: Channel-shaped bridging with lipped flanges and integral formed clips. Size and gauge: see drawings.
- H. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating required out-of-plan loading and upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- I. 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, and as follows:
1. Minimum Base-Metal Thickness: 68 mil (14 Ga) for exterior conditions and 43 mil (18 Ga) for interior conditions, unless noted otherwise.
 2. Flange Width: 1 inch plus twice the design gap – with minimum 1-1/2" overlap on stud.
- J. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 68 mil (14 Ga) for exterior conditions and 43 mil (18 Ga) for interior conditions, unless noted otherwise.
 - b. Flange Width: 1 inch plus twice the design gap.
 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: Match stud thickness, unless noted otherwise.
 - b. Flange Width: Outer deflection track flange width plus 1 inch.
- K. 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.

- L. Steel Floor or Ceiling Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch - 43 mil (18Ga).
 - 2. Flange Width: 1-5/8" minimum.
 - 3. Section Properties: See drawings.
- M. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As required for structural performance but not less than steel joists.
 - 2. Flange Width: 1-1/4 inch minimum.
- N. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch - 43 mil (18Ga).
 - 2. Flange Width: 1-5/8 inches (41 mm), minimum.
 - 3. Section Properties: see drawings.
- O. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch - 43 mil (18Ga).
 - 2. Flange Width: 1-5/8 inches (41 mm), minimum.
 - 3. Section Properties: As required for structural performance or as indicated on drawings.
- P. System Components: AISI standard load-bearing steel studs and joists of type, size, shape, and gauge as indicated. With each type of metal framing required, provide manufacturer's standard steel runners (tracks), bridging, blocking, lintels, clip angles, vertical deflection (slide) clips, shoes, reinforcements, fasteners, and accessories for application indicated as needed to provide complete metal framing system and comply with structural drawings and structural performance criteria.

2.2 ACCESSORIES

- A. Fasteners:
 - 1. Screws: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws in accordance with manufacturer's recommendations for size and spacing unless detailed otherwise in drawings.
 - a. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
 - b. Electro-plated screws are prohibited.
 - 2. Bolts and Nuts: ASTM A 307.
 - 3. Finish: Corrosion-resistant, plated finish.

- B. Provide accessories of manufacturer's standard thickness and configuration unless required for structural performance, unless otherwise indicated, as follows:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.
 5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers and knee braces.
 9. Joist hangers and end closures.
 10. Hole reinforcing plates.
 11. Backer plates.
- C. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- D. Welding Electrodes: As permitted by AWS.
- E. Power-Actuated Fasteners: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials with capability to sustain without failure a load equal to 10 times the design load as determined by testing in accordance with ASTM E 1190, performed by a qualified independent Testing Agency.
- F. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
1. "Kwik-Bolt TZ" by Hilti; "Trubolt Wedge Anchors" by ITW Ramset/Red Head; "Power-Stud" by Powers Fasteners; "Wedge-All" by Simpson/Strong-Tie; or accepted equivalent.
- G. Sleeve Anchors: "HLC Sleeve Anchor" by Hilti; "Dynabolt Sleeve Anchor" by ITW Ramset/Red Head; "Power-Bolt" by Powers Fasteners; "Sleeve-All" by Simpson/Strong-Tie; or accepted equivalent.
- H. Chemical Adhesive Anchors:
1. Anchors to solid concrete, grouted CMU, solid brick, or stone:
 - a. Anchors for use when base material temperature is 0°F or greater: "HIT-Ice" by Hilti; "Epcon A7" by ITW Ramset/Red Head; "AC 100 Plus" by Powers Fasteners; "AT Acrylic-Tie" by Simpson/Strong-Tie; or accepted equivalent.
 - b. Anchors for use when base material temperature is 40°F or greater: "HIT-HY 200 Safe Set" by Hilti; "Epcon C6" by ITW Ramset/Red Head; "T308 Plus" by Powers Fasteners; "ET Epoxy-Tie" by Simpson/Strong-Tie; or accepted

equivalent.

2. Anchors to hollow masonry (brick or hollow CMU):
 - a. Anchors for use when base material temperature is 0°F or greater: "Epcon A7" by ITW Ramset/Red Head; "AC 100 Plus" by Powers Fasteners; "AT Acrylic-Tie" by Simpson/Strong-Tie; or accepted equivalent.
 - b. Anchors for use when base material temperature is 40°F or greater: "HIT-HY 270" by Hilti; "Epcon C6" by ITW Ramset/Red Head; "T308 Plus" by Powers Fasteners; "ET Epoxy-Tie" by Simpson/Strong-Tie; or accepted equivalent.
 - c. Provide manufacturer's standard screen tubes for use with anchors.

- I. Steel Shapes and Clips: Provided under Section 051200; installed under this section.
- J. Anchor Rods: ASTM F 1554, Grade 36, threaded carbon steel hooked rods, galvanized.
- K. Nuts: ASTM A 563. Grade and finish to match rod type.
- L. Washers: ASTM F 844. Finish to match rod type.

2.3 MISCELLANEOUS MATERIALS

- A. Galvanizing Touch-up Compound: "ZRC Galvilite" by ZRC Worldwide; "Roval ZC Galvanizing Repair" by Roval Corporation; or accepted equivalent. Use for field touch-up of galvanized sheet metal.
- B. Cement Grout: Portland cement, ASTM C 150, 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: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.4 FABRICATION

- A. General: Prefabricate framing components into assemblies before erection wherever possible. Fabricate panels plumb, square, true to line, and braced against racking with joints welded. Perform lifting of prefabricated units to prevent damage or distortion.
- B. Fabricate units in jig templates to hold members in proper alignment and position and to ensure consistent component placement.
- C. Fastenings: Attach components by welding, bolting, or screw fasteners as standard with

manufacturer unless noted otherwise in drawings.

- D. Wire-tying of framing components shall not be permitted.
- E. Welds shall be fillet, plug, butt, or seam unless noted otherwise. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- F. Cut framing components squarely or on an angle required to fit tightly with proper bearing against abutting members. Maintain members firmly in position until permanently fastened.
- G. Wire-brush shop welds clean, and apply galvanizing repair paint in accordance with ASTM A 780 and manufacturer's written instructions.
- H. Fabrication Tolerances: Fabricate assemblies 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 within plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finish materials.
 - 2. Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.
 - 3. Length of end bearing members shall be within plus or minus 1/16 inch of length shown.

PART 3 - EXECUTION

3.1 INSTALLATION / ERECTION

- A. General: Examine conditions under which work shall be erected. Do not proceed until unsatisfactory conditions are corrected.
- B. Install cold-formed framing in accordance with ASTM C1007, AISI S200 "North American Standard for Cold-Formed Steel Framing - General Provisions", and the manufacturer's written instructions, whichever is more stringent.
- C. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- D. Handling and lifting of members or prefabricated panels shall be done in a manner to not cause distortion in members. Lift only at points indicated in Shop Drawings.
- E. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as shown in drawings, except do not exceed 24 inches on center spacing for nail or power-driven fasteners or 16 inches on center for other types of attachment. Provide fasteners at corners and ends of tracks.

1. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab to ensure a uniform bearing surface on supporting concrete or masonry construction.
- F. At track butt joints, abutting pieces of track shall be securely anchored to a common structural element or they shall be butt-welded or spliced together.
- G. Installation of Wall Studs: Secure studs to top and bottom runner tracks by either welding or screw-fastening at both inside and outside flanges as shown in drawings. Do not screw or weld non-load bearing studs to vertical deflection clips or deflection slip tracks.
1. Set studs plumb except as needed for diagonal bracing or as required for nonplumb walls or warped surfaces and similar requirements.
 2. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) 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:
 - a. Stud Spacing: As indicated in structural drawings and approved shop drawings.
 3. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
 4. Align studs vertically where floor framing interrupts load-bearing wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
 5. Align floor and roof framing over load-bearing studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
 6. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of bridging to supporting structure.
 7. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 8. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
 9. Install runner 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.
 10. Install horizontal bridging in stud system, spaced as indicated on structural drawings / on Shop Drawings. Fasten at each stud intersection and anchor bridging lines to bottom and/or top tracks as indicated.
 - a. 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 8 inches (150 mm) deep.
 - b. 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.
 - c. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

11. Install supplementary framing, blocking, and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards, considering weight or loading resulting from item supported.
 12. Install steel sheet diagonal bracing straps for bridging anchorage or shear walls 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.
 13. 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.
 14. Frame both sides of expansion and control joints with separate studs. Do not bridge the joint with components of stud system.
 15. Framing system shall be constructed to maintain clearances to allow for construction tolerances and to accommodate live load deflection of primary building structure as indicated in drawings.
- H. Installation of Joists: Install level, straight, and plumb, complete with bracing and reinforcing as indicated in drawings. Provide not less than 1 1/2-inch end bearing.
1. Reinforce ends with end clips, steel hangers, steel angle clips, or steel stud section as recommended by joist manufacturer unless shown otherwise in drawings.
 2. Reinforce joists at interior supports with web stiffeners directly over interior support as shown in drawings.
 3. Secure joists to interior support systems to prevent lateral movement of bottom flange.
 4. Install horizontal bridging in joist system spaced 8 feet maximum on center. Weld or screw at each intersection. Provide solid bridging at first two end bays and at 10 feet maximum on center.
- I. Bridging, blocking, and sheathing shall be in place prior to loading roof framing.
- J. Cutting of flanges in joist, stud, and header framing members shall not be permitted.
- K. Splicing of joist, stud, and header framing members shall not be permitted.
- L. Axially loaded members shall be aligned vertically. Vertical alignment of studs and joists shall be maintained at floor-to-wall and roof-to-wall intersections.
- ### 3.2 ERECTION TOLERANCES
- A. Framing and prefabricated assemblies:
1. Length of end bearing members: $\pm 1/16$ inch.
 2. Vertical alignment of studs: $\pm 1/8$ inch in 10 feet.
 3. Horizontal alignment of walls: $\pm 1/8$ inch in 10 feet; 1/4-inch maximum deviation from theoretical line.

4. Framing spacing: \pm 1/8 inch from design spacing; 1/2-inch maximum cumulative error.
 5. Maximum variation in plane and true position between prefabricated assemblies should not exceed 1/4 inch.
- B. Bolt or weld wall panels at both horizontal and vertical junctures to produce flush, even, true-to-line joints.

3.3 FIELD QUALITY CONTROL

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

3.4 TOUCH-UP PAINTING

- A. After installing framing, wire-brush, clean, and paint scarred areas (scratches, weld burn marks, etc.), welds (shop and field), and rust spots on both surfaces of framing units and supporting steel members.
1. Touch up paint-damaged galvanized surfaces and welded areas with galvanizing touch-up compound in accordance with manufacturer's instructions.

END OF SECTION 05 4000

SECTION 05 5000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Steel ladder.
2. Aluminum ladder
3. Aluminum alternating tread stairs.
4. Steel stairs with concrete-filled treads.
5. Handrails and railings at stairs.
6. Handrails attached to walls adjacent to stairs.
7. Guardrails.
8. Support angles for elevator door sills.
9. Loose bearing and leveling plates.
10. Loose steel lintels.
11. Shelf angles.
12. Steel framing and supports for ceiling hung equipment.
13. Steel framing and supports for mechanical and electrical equipment.
14. Steel framing and supports for applications where framing and supports are not specified in other Sections.
15. Steel elevator sump pit gratings.
16. Mechanical room floor grating.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal stairs, handrails and railings, guardrails, and ladders.
- B. Structural Performance of Ladders: Ladders shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- C. Structural Performance of Metal Stairs, Walkways and Platforms: Provide metal stairs, walkways and platforms capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of metal stairs, walkways and platforms.
1. Treads and Platforms of Metal Stairs, and Walkways: Capable of withstanding a uniform load of 100 lbf/sq. ft. (4.79 kN/sq. m) or a concentrated load of 300 lbf (1.33 kN) on an area of 4 sq. in. (25.8 sq. cm), whichever produces the greater stress.
 2. Stair and Walkway Framing: Capable of withstanding stresses resulting from loads specified above in addition to stresses resulting from railing system loads.

3. Limit deflection of treads, platforms, walkways and framing members to $L/360$ or $1/4$ inch (6.4 mm), whichever is less.
- D. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding the following structural loads without exceeding the allowable design working stress of materials for handrails, railings, anchors, and connections:
 1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
 - b. Uniform load of 50 lbf/ft. (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf/ft. (1460 N/m) applied vertically downward.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
 - b. Uniform load of 50 lbf/ft. (730 N/m) applied in any direction.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 3. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.
 - a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guards.

1.3 ACTION SUBMITTALS

- A. Product Data: For all fabricated products including the following:
 1. Gratings.
 2. Paint products.
 3. Grout.
 4. Nonslip aggregates and nonslip-aggregate surface finishes
 5. Ladders
 6. Fabricated railing systems
 7. Alternating tread stairs
- B. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel within this specification section, if available. A statement of the contractor's good faith effort to obtain the EPD shall be provided if not available.
 1. Manufacturer provided EPDs must be Product Specific Type III (Third Party Reviewed), in adherence with ISO 14025 Environmental labels and declarations, ISO 14044 Environmental management Life cycle assessment, and ISO 21930 Core rules for environmental product declarations of construction products and services.

- C. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

- 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- D. Samples for Verification: Sample of the following:

- 1. 6" square piece of each type of bar grating.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding Certificates: Copies of certificates for welding procedures and personnel.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Delegated-Design Submittal: For stairs, handrails and railings, guardrails, and ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing metal fabrications 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.
- B. 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 metal stairs, platforms, walkways, and handrails and railing systems that are similar to those indicated for this Project in material, design, and extent.
- C. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 3. AWS D1.2, "Structural Welding Code--Aluminum."
 - 4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- D. Mockups: Build mockups of each type of handrail, railing and guardrail system to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Each mock-up shall consist of a typical panel including two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches (600 mm) in length.
2. Notify Architect seven days in advance of dates and times when mock-up will be constructed
3. Remove/dismantle and reprepare mock-up as required to obtain Architect's approval.
4. Approved mock-ups may be incorporated in the finished work.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.7 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. 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.

1.8 SEQUENCING AND SCHEDULING

- A. Sequence and coordinate installation of wall handrails as follows:
1. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.
 2. Mount handrails only on gypsum board assemblies reinforced to receive anchors, and where the location of concealed anchor plates has been clearly marked for benefit of Installer.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: For metal fabrications 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.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating.
- C. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads. For exterior installations and where indicated, provide pipe with hot-dip galvanized coating.
- D. Slotted Channel Framing: Cold-formed metal channels with flange edges returned toward web and with 9/16-inch- (14.3-mm-) wide slotted holes in webs at 2 inches (51 mm) o.c.
 - 1. Width of Channels: 1-5/8 inches (41 mm).
 - 2. Depth of Channels: As indicated.
 - 3. Metal and Thickness: Galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108-inch (2.8-mm) nominal thickness.
 - 4. Finish: Unfinished.
- E. Steel Bars for Gratings: ASTM A 36/A 36M.
- F. Wire Rod for Grating Crossbars: (ASTM A 510M)
- G. Malleable-Iron Castings: ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).
- H. Gray-Iron Castings: ASTM A 48, Class 30 (ASTM A 48M, Class 200), unless another class is indicated or required by structural loads.
- I. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- J. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 ALUMINUM

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T6, 6036-T5, 6005-T5 or 6061-T6.
- B. Extruded Structural Pipe: ASTM B 429, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated

- C. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
- D. Extruded Bars, Shapes and Mouldings: ASTM B 221 (ASTM B 221M), alloy 6063-T6 or 6063-T52.
- E. Castings: ASTM B 26, Almag 35.

2.4 PAINT

- A. Shop Primer for Interior Ferrous Metal: Modified oil-alkyd primer, Tnemec 88-559 or 10-1009, or equivalent. Primer shall be compatible with finish paint specified in Section 09900.
- B. Shop Primer for Galvanized Ferrous Metal: Polyamide epoxy primer, Tnemec F.C. Typoxy Series 27, or equivalent. Primer shall be compatible with finish paint specified in Section 09900.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- D. Shop Primer for Exterior Ferrous Metal: Organic zinc-rich primer, complying with SSPC-Paint 20 and compatible with topcoat; Tnemec-Zinc 90-97; Tnemec Company, Inc.
- E. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FASTENERS

- A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls, except as noted below. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
- D. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.
- G. Plain Washers: Round, carbon steel, ASME B18.22.1 (ASME B18.22M).

- H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1 (ASME B18.21.2M).
- I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
- J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.6 GROUT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 CONCRETE FILL

- A. Concrete Materials and Properties: Normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless higher strengths are indicated.

2.8 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Shear and punch metals cleanly and accurately. Remove burrs.
- C. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- J. Remove sharp or rough areas on exposed traffic surfaces.
- K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.9 ROUGH HARDWARE

- A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.
- B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.10 METAL STAIRS

- A. General: Construct stairs to conform to sizes and arrangements indicated. Join pieces together by welding, unless otherwise indicated. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary for the support of stairs, and platforms, and as required to anchor, hang, and contain the stairs on the supporting structure.

- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. Commercial class.
- C. Stair Framing: Fabricate stringers of structural steel channels, or plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Weld headers to strings, and framing members to strings and headers.
 - 1. Where required, provide hanger rods to support landings from floor construction above. Locate hanger rods within stud space of shaft-wall construction.
 - 2. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- D. Metal Risers, Subtread Pans, and Subplatforms: Form to configurations shown from steel sheet of thickness necessary to support indicated loads, but not less than 0.0677 inch (1.7 mm).
 - 1. Steel Sheet: Uncoated cold-rolled steel sheet, unless otherwise indicated.
 - 2. 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.
 - 3. Shape metal pans to include nosing integral with riser.
- E. Steel Stair Finishes:
 - 1. Shop prime and field paint all steel stairs systems

2.11 HANDRAILS AND RAILINGS AND GUARDRAILS

- A. General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
- B. Interconnect members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.
 - 1. At tee and cross intersections of pipe and tube, cope ends of intersecting members to fit contour of tube to which end is joined, and weld all around.
- C. Form changes in direction of handrails and rails as detailed.
- D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

- E. Close exposed ends of pipe and tube handrail and railing members with prefabricated end fittings.
- F. 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 (6 mm) or less.
- G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting railings and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 1. Connect railing posts to metal framing by direct welding, unless otherwise indicated.
 - 2. Connect railing posts to concrete by inserting into preset sleeves, attaching to floor brackets, or core drilling, as indicated.
- H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.
- I. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- J. For railing posts set in concrete, provide steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with steel plate forming bottom closure.
- K. For galvanized handrails and railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
- L. For nongalvanized handrails and railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
- M. Steel Handrail Finishes:
 - 1. Provide black finish for steel pipe and non-galvanized finish for other steel components of interior steel railings and handrails. Provide nongalvanized ferrous metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in masonry and concrete construction.
 - 2. Provide hot-dipped galvanized finish for all components of exterior steel handrail and railing system including fittings, brackets, anchors, fasteners, and sleeves.
 - 3. Shop prime and field paint all steel handrails and railings.

2.12 STEEL LADDERS

- A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.

1. Comply with ANSI A14.3, except for elevator pit ladders.
 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Siderails: Continuous, 1/2-by-2-1/2-inch (12-by-64-mm) steel flat bars, with eased edges, spaced 18 inches (457 mm) apart.
- C. Bar Rungs: 3/4-inch- (19-mm-) diameter steel bars, spaced 12 inches (300 mm) o.c.
- D. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.
- E. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.
- F. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
- G. Galvanize ladders, including brackets and fasteners, in the following locations:
1. Exterior.
 2. Interior, where indicated.

2.13 ALUMINUM LADDER

- A. Fabricate aluminum ladders of open-type construction with heavy duty tubular side rails and tubular extruded serrated rungs. Provide brackets and fittings for installation
1. Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch wall thickness by 3 inches wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.
 2. Rungs: Extruded tubular serrated treads 1-1/4" diameter, 18-3/8" long.
 3. Product: Provide Model 501 Heavy Duty Tubular Rail Fixed Access Ladder manufactured by O'Keeffe's Inc. or equal.
 4. Finish: Painted urethane finish in Caution Yellow.
 5. Provide security doors formed from 1/8 inch thick aluminum sheet. Security panels shall extend on both sides, perpendicular to the door face, to within 2 inches of the wall. Security door shall be furnished with continuous aluminum piano hinge and heavy duty forged steel locking hasps.
 6. Provide ladder safety post with retractable hand hold and tie off.

2.14 ALUMINUM ALTERNATING TREAD STAIRS

- A. Fabricate aluminum alternating tread stairs of open-type construction with fully welded construction. Provide brackets and fittings for installation
1. Angle of Inclination: 68 degrees.

2. Stringers: HSS 1-3/4" x 4" x 1/8" aluminum alloy 6063-T52
3. Handrails: 1-1/2" diameter x 1/8" aluminum tube alloy 6063-T4.
4. Treads, Landings, and Foot Castings: Aluminum alloy F356F.
5. Product: Provide Lapeyre Stairs by Lapeyre Stair Inc., or equal. .
6. Finish: Mill.

2.15 METAL GRATINGS

- A. Metal Bar Gratings: Form to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual"
 1. Steel Gratings: Fabricate from welded steel grating with 1-1/4-by-3/16-inch (32-by-5-mm) bearing bars at 15/16 inch (24 mm) o.c. and crossbars at 4 inches (100 mm) o.c., NAAMM designation: W-15-4 (1-1/4 x 3/16) STEEL. Surface shall be smooth.
 - a. Application: Elevator pit sump pit cover and mechanical room floor grating.
- B. Steel Frames: Fabricate from ASTM A 36/A 36M steel angle, 1-1/2" x 1-1/2" x 1/4" in size unless otherwise noted, with welded anchor for casting into slab.
- C. Fabricate grating with steel angle or steel plate carrier at each end for attachment to frame. Secure grating to frame with removable bolts; provide tamper proof bolts for exterior locations.
- D. Do not notch bearing bars at supports to maintain elevation
- E. Steel Grating Finishes:
 1. Provide hot-dipped galvanized finish for all components of elevator pit gratings and mechanical room floor gratings including fittings, brackets, anchors, fasteners, and sleeves.
 2. Provide hot-dipped galvanized finish for all steel frames for gratings.
 3. Shop prime and field paint all steel gratings and steel framing members.

2.16 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates after fabrication.

2.17 LOOSE STEEL LINTELS

- A. Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Weld adjoining members together to form a single unit where indicated.

- C. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches (200 mm), unless otherwise indicated.
- D. Galvanize loose steel lintels located in exterior walls.
- E. Shop prime and field paint all lintels, leave embedded portions of lintels unpainted.

2.18 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
- B. Galvanize shelf angles to be installed in exterior walls.
- C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.19 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.
- B. Fabricate units from structural-steel shapes, plates, tubes, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long at 24 inches (600 mm) o.c., unless otherwise indicated.
 - 3. Furnish inserts if units must be installed after concrete is placed.
- C. Fabricate framing and supports for solid surface countertops from steel shapes and connectors as detailed on Drawings; prime paint and finish paint fabricated supports.
- D. Galvanize miscellaneous framing and supports where indicated, and in exterior locations.

2.20 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.21 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware..
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes indicated as unpainted, and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Paint embedded steel that is partially exposed on exposed portions and initial 2 inches of embedded areas only.
 - 1. Do not paint surfaces to be welded or high-strength bolted with friction-type connections.
 - 2. Apply 2 coats of paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.22 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Urethane Paint: Manufacturer's standard process.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.
- B. 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.

- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. 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.
- E. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

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

3.3 INSTALLING RAILINGS AND HANDRAILS

- A. Adjust handrails and railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
 - 1. Anchor posts to steel by welding directly to steel supporting members.
 - 2. Use steel pipe sleeves preset and anchored into concrete for installing posts where indicated. 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. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch (3-mm) buildup, sloped away from post.

3. Where indicated, core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) 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
 4. Cover anchorage joint of post with flange of same metal as post where indicated.
 5. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
 6. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
- B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
1. Use type of bracket with predrilled hole for exposed bolt anchorage.
 2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 3. For hollow masonry anchorage, use toggle bolts.
 4. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members

3.4 SETTING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.
- B. 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.

1. Where grout space under bearing plates is indicated at girders supported on concrete or masonry, install as specified above for setting and grouting bearing and leveling plates.

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 5000

SECTION 05 5200 - GALVANIZED STEEL HANDRAIL FOR SITEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Requirements for furnishing all labor, materials, tools, and equipment, and performing all operations necessary for galvanized steel handrails
- B. Related Sections:
 - 1. Division 32 Section 1313 "Concrete Paving".
- C. Cited Standards
 - 1. National Association of Architectural Metal Manufacturers (NAAMM) – Metal Finishes Manual for Architectural and Metal Products
 - 2. Americans with Disabilities Act Accessibility Guidelines (ADAAG)
 - 3. New York State Building Code 2010 or latest edition
 - 4. Occupational Safety and Health Administration (OSHA)
 - 5. American Society for Testing and Materials (ASTM) A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware

1.2 ACTION SUBMITTALS

- A. Shop Drawings – Include plans, elevations, sections. Indicate standard and optional component features, dimensions, materials, anchoring details, and other items required for fabrication and installation.
 - 1. Engineering analysis and calculations signed and sealed by a Professional Engineer who is a Licensed Professional Engineer registered in the State of New York.
- B. Sustainable Design Submittals:
 - 1. Submit an Environmental Product Declaration (EPD) from the manufacturer for Steel within this specification section, if available. A statement of the contractor's good faith effort to obtain the EPD shall be provided if not feasible.
 - a. Manufacturer provided EPD's must be Product Specific Type III (Third Party Reviewed), in adherence with ISO 14025 Environmental labels and declarations, ISO 14004 Environmental Management Life Cycle Assessment, and ISO 21930 Core rules for environmental product declarations of construction products and services.
- C. Samples – include both materials and finishes.
- D. Railing Panel Schedule

- E. Installation Template(s)
- F. Maintenance Data
- G. Provide the following a minimum five (5) days prior to material delivery:
 - 1. Welding Inspection Reports in accordance with AWS.
 - 2. Mill Certificates signed by product manufacturers, certifying that products furnished comply with applicable ASTM specifications.
 - 3. Anodized Product's Test Reports verifying compliance with AAMA611 class 1 anodizing.
 - 4. Certificates signed by Fabricator certifying that the products provided were in accordance with Stony Brook University requirements and approved shop drawings.

1.3 QUALITY CONTROL

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer, unless otherwise approved by the Architect.
- B. Qualify Welding procedures and personnel according to the following AWS D-19.0 "D1.2 Welding Zinc Coated Steel".
- C. Fabricator shall have ISO 9001:2008 Certification, and three (3) years experience in fabricating galvanized steel railings similar to railings as required by this specification.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls, platforms, expansion joints and other construction contiguous with metal fabrications by field measurements before fabrication.
- B. Existing platform and stair width shall not be reduced by new railing installation, unless otherwise approved by the Architect.
- C. Field verified dimension prior to shop drawing preparation. Fabricator shall indicate measurements on Shop Drawings.
- D. Railing Contract Drawings serve only as a basis of design for new railing system. Contractor to perform a survey to establish exact railing dimensions, quantities, locations, stair angles and dimensions, locations of walls and obstructions, existing railings, and attachment locations, and indicate all necessary dimensions on the Shop Drawings.

1.5 COORDINATION AND SCHEDULING

- A. Coordinate with the Architect for delivery dates and delivery locations.

- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages. Deliver such items to Project site in time for installation.
- C. Schedule installation so attachments are made only to completed construction. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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. The allowable design working stresses of aluminum railing materials is based on minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
 - 2. Railings shall be capable of withstanding the effects of gravity loads and the following minimum loads and stresses within limits and under conditions indicated:
 - a. Uniform continuous load of 100 pounds per linear foot applied horizontally or vertically on guardrail.
 - b. Uniform continuous load of 60 pounds per linear foot applied horizontally on infill.
 - c. Concentrated load of 365 pounds applied horizontally on top guardrail or railing post.
 - d. Concentrated load of 250 pounds applied vertically on top or bottom guardrail.
 - e. Uniform and concentrated loads need not be assumed to act concurrently.
 - 3. Railing systems shall be fabricated to withstand live loads for Assembly Areas in accordance with the American Society for Testing and Materials (ASTM) E 985 – Standard Specification for Permanent Metal Railing Systems and Rails for Buildings, including requirements for Assembly Areas with potential of Impact and Panic Loadings.
- B. Railings shall be fabricated to allow for thermal movements by preventing buckling, opening of joints, overstressing of components and connections, failure of connections, and other detrimental effects, resulting from the following maximum range in ambient and material surface temperature.
 - 1. Temperature Range: 120 degrees Fahrenheit ambient; 180 degrees Fahrenheit material surface due to solar heat gain and nighttime sky heat loss.
- C. Railings shall be fabricated to withstand exposure to coastal environment, severe weather, deicing chemicals, UV exposure, chipping, cracking, crazing, erosion, abrasion and impact.

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.

2.3 STAINLESS STEEL HANDRAILS

- A. Tubing: ASTM A554, Grade MT 316L.
- B. Pipe: ASTM A312, Grade TP 316L.
- C. Components
 - 1. Minimum height of 34 inches and a maximum of 38 inches, measured from top of handrail to stair tread or ramp surface, in accordance with ADAAG requirements.
 - 2. Handrails shall be continuous on stairways, ramps or at other locations as required by ADAAG.
 - 3. Handrail ends shall be either rounded or returned smoothly to floor, wall or post leaving no open ends.
 - 4. Handrail design shall not interfere with glass installation/repairs in stairways or overpasses.
- D. Handrail profile: Circular cross sections as indicated in the Contract Drawings.
- E. Handrail to be 1-1/2" schedule 40, wall thickness of 0.145" or as indicated in the Contract Drawings.

2.4 MATERIALS

A. GALVANIZED STEEL

- 1. Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- 2. Provide stainless steel and aluminum alloy and temper recommended by material producer and finisher for type of use and finish indicated, for marine type environment, and with not less than the strength and durability properties of alloy and temper designated on Stony Brook University drawings for each aluminum form required.
- 3. Provide Welding Rods and Bare Electrodes type and alloy as recommended by producer of aluminum and stainless steel metal to be welded and as required for finishing, strength, and compatibility of welded items.
- 4. Welding shall be according to AWS specifications for metal alloy welded, no undercut and no material added.

2.5 FASTENERS

- A. Fastener Materials:
 - 1. Stainless Steel Railing Components: Type 316 stainless steel fasteners.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.

1. Wedge-type anchors shall not be used; anchor bolts shall be drilled and epoxy adhesive type.
- C. Fasteners for Interconnecting Railing Components:
 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 3. 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, according to 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 2 stainless steel bolts, ASTM F593, and nuts, ASTM F594.
- 2.6 Provide security type 410 stainless steel self-drilling fasteners for interconnecting guardrails to post.
- 2.7 Concrete anchoring system: Chemical type anchors, type 316 stainless-steel threaded rod with hex nuts and washers, and fast curing epoxy adhesive.
 1. Epoxy adhesive for anchoring to concrete shall be HILTI HIT-HY200 approved equal.
- 2.8 MISCELLANEOUS MATERIALS
 - A. Non-shrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 - B. Anchoring Cement: Factory-packaged, non-shrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 1. 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.
- 2.9 FABRICATION
 - A. Fabricate railings in accordance with this specification and approved shop drawings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required for supporting structural loads.

- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as directed by Stony Brook University and necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware and fasteners.
- G. 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 surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- H. Form changes in direction required by radius bends of radius indicated or by inserting prefabricated flush elbow fittings of radius indicated.
- I. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- J. Close exposed ends of railing members with prefabricated end fittings.
- K. Brackets, Flanges, and Fittings: Provide brackets, flanges, and miscellaneous fittings to interconnect railing members.

2.10 MANUFACTURERS

- A. Manufacturers – Provide single manufacturer for aluminum and stainless steel assembly systems of one of the following approved fabricators:
 - 1. PennFab, Inc. 20 Steel Road South, Morrisville, PA 19067; Telephone (215) 245-1577, Website: www.pennfab.com; Email: info@pennfab.com
 - 2. or approved equal.
- B. Source Limitations: Obtain each type of railing from single source from single manufacturer. Provide products by the same manufacturer for each type of product specified.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions for compliance with requirements for installation and tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Perform survey to establish exact stair and railings angles and dimensions, locations of walls, existing railings and other construction continuous with railings before fabrication.
- D. Provide field dimensions to fabricator prior to shop drawing preparation.

3.2 PREPARATION

- A. Contractor will prepare existing conditions for receiving railings.
- B. Provide product data before shop drawing preparation, for the Architect approval.
- C. Prepare shop drawings including field dimensions and submit to the Architect for review, comments, and approvals.
- D. Proceed with Fabrication after shop drawing approvals.
- E. Coordination and prepare existing conditions for receiving stairs and railings.

3.3 INSPECTION AND ACCEPTANCE

- A. Railing products and production process shall be subject to inspection by the Architect.
- B. Products may be rejected due to, but not limited to, the following:
 - 1. Failure to comply with approved process.
 - 2. Deviation from approved samples, shop drawings and Stony Brook University requirements.
 - 3. Dimensions not conforming to field conditions and approved shop drawings.
 - 4. Defects that in the opinion of the architect would affect the structural integrity of the railing assembly.
 - 5. Railing member or assembly warping.
 - 6. Any design or material feature not complied with.
 - 7. Defects that, in the opinion of the architect, indicate lack of proper workmanship including, but not limited to, the following:
 - a. Cracks as a result of improper lifting or improper storage.
 - b. Cracks as a result of improper welding.
 - c. Surface scaling and visual defect as a result of improper cleaning and finishing.
 - d. Major defects as a result of mechanical damage such as striking objects during lifting.
 - e. Stresses induced in members due to poor workmanship.

3.4 INSTALLATION AND MAINTENANCE

- A. Deliver railings at locations and quantities as directed by Stony Brook University and the Architect.
- B. Contractor will unload, protect, and install railings in accordance with Manufacturer's written instructions.

END OF SECTION 05 5200

SECTION 05 5813 – METAL COLUMN COVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes aluminum composite material column covers for interior locations.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Show fabrication and installation details for column covers.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design.
- D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch- (150-mm-) square Samples of metal of same thickness and material indicated for the Work.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing column covers similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver column covers wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

PART 2 - PRODUCTS

2.1 METAL COLUMN COVERS

- A. Aluminum Composite Material Column Covers: Provide factory-formed, metal column covers formed into profile for installation method indicated. Include attachment assembly components and accessories required for installation of type indicated.
 - 1. Aluminum Composite Material Covers: Formed from Alpolic, Alucobond, or Reynobond 4mm ACM with fire-retardant core.

2. Column Shape: Square
3. Column Cover Configuration: Vertical butt joint incorporating a key slot design, with mechanical attachment for exterior and stacking conditions, flush to ceiling and with flush extruded base, with intermediate butt stack joint only as required due to column height, with factory supplied alignment plates
4. Size of Columns: As indicated on Drawings.
5. Finish: Kynar 500 Paint – Fluoropolymer, in color selected by Architect
6. Basis of Design Product: Series C-1000 by Southern Aluminum Finishing Company Inc. (SAF), or equal by one of the following:
 - a. AlumaFab Metal Sales
 - b. Northclad

B. Fabrication

1. Form column covers to specified dimensions and diameters as indicated on shop drawings.
2. Column covers shall be self-aligning with attachment clips at maximum 18" o.c. to assure solid attachment to post structures.
3. Form radii to achieve true and smooth surfaces.
4. Provide column covers in sections a maximum 12'- 0" tall per section. Provide additional sections to achieve finished heights above 12'- 0".
5. Columns shall have no exposed fasteners.

2.2 MISCELLANEOUS MATERIALS

- A. Fasteners: Self drilling stainless steel fasteners. Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
- B. Brackets, Angles, Clips: Provide manufacturer's standard brackets and clips for installing to structural columns as required for complete installation.

2.3 FABRICATION, GENERAL

- A. Coordinate dimensions and attachment methods of column covers with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
- B. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of column covers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate and place column covers plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install column covers.
 - 1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- B. Use concealed anchorages.
- C. Form tight joints with exposed connections accurately fitted together.
- D. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 ADJUSTING AND CLEANING

- A. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.4 PROTECTION

- A. Protect finishes from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 05 5813

SECTION 06 1053 - MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Wood blocking, cants, furring, supports, and nailers.
 - a. Provide for Owner-furnished, Owner-installed and Owner-furnished, Contractor-installed equipment and furnishings as well. Coordinate with Owner for requirements.
2. Plywood backing panels.

1.2 DEFINITIONS

A. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority.
3. SPIB - Southern Pine Inspection Bureau.
4. WCLIB - West Coast Lumber Inspection Bureau.
5. WWPA - Western Wood Products Association.

1.3 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, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - 1. Preservative-treated wood.
 - 2. Fire-retardant-treated wood.

1.5 QUALITY ASSURANCE

- A. All composite wood, engineered wood, or agrifiber products (e.g., plywood, particleboard, medium density fiberboard) shall contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and methyl diisocyanate (MDI).

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. 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 lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Provide dressed lumber, S4S, unless otherwise indicated.
 - 3. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, and Use Category UC3b for exterior construction not in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 - 2. The use of CCA preservative treated wood is prohibited.

- B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
- C. Mark each treated item with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee 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, furring, 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, provide materials that comply with performance requirements in AWPAC20 (lumber) and AWPAC27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood.
 - 2. Use treatment that does not promote corrosion of metal fasteners.
 - 3. Use Exterior type for exterior locations and where indicated.
 - 4. Use Interior Type A High Temperature (HT), unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

- A. Provide miscellaneous lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Furring.
 - 4. Sleepers
 - 5. Cants
- B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content and the following species: Mixed southern pine; SPIB.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content of the following species and grades:

1. Spruce-pine-fir (south) or Spruce-pine-fir, Construction or 2 Common grade; NELMA, NLGA, WCLIB, or WWPA.

2.5 PLYWOOD PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch (12.7 mm) thick.

1. Paint before mounting of equipment.

- B. Miscellaneous Concealed Plywood: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch (13 mm).

1. Provide fire-retardant-treated panels for interior locations unless indicated.
2. Provide preservative-treated panels for exterior locations unless indicated.

2.6 MISCELLANEOUS MATERIALS

- A. Fasteners:

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
2. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.7 ACCESSORY MATERIALS

- A. Weather Resistant Barrier: Asphalt-saturated organic felt, ASTM D 226, Type 1 (No. 15 asphalt felt), unperforated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Apply field treatment complying with AWWA M4 to cut surfaces of preservative-treated lumber and plywood.

- D. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.
- E. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.2 PANEL PRODUCT INSTALLATION

- A. Fastening Methods: Fasten panels as indicated below:
 - 1. Plywood Backing Panels: Screw to supports.
 - 2. Miscellaneous Concealed Plywood Panels: Screw to supports.

3.3 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION 06 1053

SECTION 06 1643 - GYPSUM SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Sheathing joint and penetration treatment.

B. Related Requirements:

1. Division 07 Section "Fluid-Applied Membrane Air and Moisture Barriers" for moisture-resistive barrier applied over wall sheathing.

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Source Limitations:** Obtain each gypsum sheathing product through one source from a single manufacturer.

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.**

1.5 SEQUENCING AND SCHEDULING

- A. Sequence installing sheathing with installing exterior cladding to comply with requirements indicated below:**
1. Do not leave glass-mat gypsum sheathing board exposed to weather for more than 180 days.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:** For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory," or GA-600, "Fire Resistance Design Manual."

- B. Vertical and Lateral Fire Propagation Test Characteristics: The exterior wall assembly is required to comply with NFPA 285 "Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components." The base wall, stud cavity insulation, wall sheathing, air barrier, continuous wall rigid insulation and exterior cladding are components that are required to be evaluated as part of this specific assembly test. Gypsum sheathing shall be part of an assembly that has passed NFPA 285 testing.

2.2 GYPSUM SHEATHING, 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 WALL SHEATHING

- A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. National Gypsum Company; Gold Bond eXP.
 - b. United States Gypsum Co.; Securock.
 - c. Georgia Pacific; DensGlass
2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
3. Size: 48 by 96 inches (1219 by 2438 mm) or 48 by 120 inches (1219 by 3048 mm) for vertical installation.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. 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, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 1. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) 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 (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), 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.
2. VOC Content: Sealants and finishing materials shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".
3. Sealants and tapes shall be compatible with air and moisture barrier specified in Section 072726

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 manufacturer's published instructions.
- D. Coordinate wall sheathing installation with air and moisture barrier 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 cold-formed metal framing with screws.
 2. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
 3. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
 1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

D. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion 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 1643

SECTION 06 4020 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Plastic-laminate cabinets and casework, including apron at ADA vanities.
2. Plastic laminate shelving units

B. Related Work Specified Elsewhere:

1. Composite quartz countertops are specified in Division 12 Section "Simulated Stone Countertops."

1.2 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including cabinet hardware and accessories, and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips and clips, cabling and connectors, and attachment devices, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, wire management, and other items installed in architectural woodwork.

C. Samples for Verification: For the following:

1. Plastic-laminate-clad products, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished comply with requirements.
- B. Qualification Data: For installers and fabricators of architectural woodwork.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.
 - 1. Provide certification on company letterhead indicating that woodwork complies with requirements of AWI grades specified.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where 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 enclosed and indicate measurements on Shop Drawings.

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- C. Wood Products: Comply with the following:
 - 1. Hardboard: Tempered, S1S, Class 1 minimum 1/4 inch and conforming to PS 58-73.
 - 2. Particleboard: Minimum 48 lb. density, straw-based particleboard complying with requirements in ANSI A208.1, Grade M - 2, except for density.
 - 3. Medium-Density Fiberboard: ANSI A208.2, Grade 130
 - 4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 - 5. Hardwood Plywood and Face Veneers: HPVA HP-1.
- D. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.
 - 1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
 - 1. Colors, Patterns and Finishes: As scheduled.
 - 2. Basis of Design Products: Provide Wilsonart laminates in Standard HPL finish, or equal by one of the following:
 - a. Formica Corporation.
 - b. Laminart.
- F. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware."
- B. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
 - 2. Other specific finishes as scheduled.
- C. Bumpers: Clear pressure sensitive non-skid vinyl bumpers 1/2 inch diameter by 5/32 inches thick; Grass #GF-BP-C, or equivalent.
- D. Frameless Concealed Hinges (European Type): 180 degrees of opening, self-closing, three-way adjustable; Grass #GF-1200VX-8, or equivalent.
- E. Catches: Magnetic catches, 5 lb. holding power; Ives 324-P69, or equivalent. Provide 1 top mounted at each door.
- F. Wire Pulls: Back mounted, solid stainless steel, 4 inches long, 5/16 inch in diameter.
- G. Wire Management Grommets: Plastic grommets with cut-out covers cap, 1-1/2 inch I.D. unless otherwise indicated; Hughes Plastic Parts, or equivalent. Color as selected by Architect from manufacturer's standard colors.
- H. Drawer Slides: 3/4 extension type, constructed from zinc plated cold-rolled steel, with ball-bearing rollers, 75 lbf (330 N) load rated; Accuride 214 Series, or equivalent.
- I. Slides for File Drawers: Full extension type, constructed from zinc plated cold-rolled steel, with ball-bearing rollers, 200 lbf (890 N) load rated; Accuride 4437 Series, or equivalent.
- J. Pencil Drawer Slides: 45 lbf (200 N), Accuride 214 Series, or equivalent
- K. Adjustable Shelf Supports: Peg type, steel, 5/16" stem length, 1/4" bore, spoon width 25/64"; Progressive IF-739NP, or equivalent.
- L. Locks: Door locks - NL-C8173-26D; drawer locks - NL-C8178-26D; strike - NL-C2004-14A; National Cabinet Lock, or equivalent. Keyed as requested by Owner.
- M. Levelers: Plastic leveling system, including socket, leveler, toe kick clip, and toe kick handle; Camar model CM-835-E1-00, CM-345-10-P2, CM-202-V1-T2, and CM-230-01-DE, or equivalent.

2.3 ACCESSORIES

- A. Shelving: 3/4" thick with 3 mm PVC kerfed edges, unless otherwise indicated.
 - 1. Provide plastic laminate faced panel product where scheduled or indicated on drawings.
- B. Adjustable Shelf Supports: Decorative, heavy-duty double-slotted standards adjustable on 1-1/4" centers with decorative brackets in length indicated on drawings. Include all accessories including cover strips, end caps, joiners, spacers and fasteners, as required for complete installation. Provide with epoxy finish in color as selected by Architect from manufacturer's standards.
 - 1. Product: Knap & Vogt #82 standards and #182 brackets, or equivalent.

2.4 INSTALLATION MATERIALS

- A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.5 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide Premium grade interior woodwork complying with the referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm)
- D. Complete fabrication, including assembly, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

- E. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.6 PLASTIC-LAMINATE CABINETS AND CASEWORK

- A. Quality Standard: Comply with AWI Section 10 requirements for custom laminate cabinets.
- B. Grade: Premium
- C. AWI Type of Cabinet Construction: Full overlay.
- D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Horizontal Surfaces Other Than Tops: HGS.
 - 2. Postformed Surfaces: HGP.
 - 3. Vertical Surfaces: HGS.
 - 4. Edges: HGS
- E. Materials for Semiexposed Surfaces Other Than Drawer Bodies:
 - 1. Drawer Sides and Backs: Thermoset decorative overlay.
 - 2. Drawer Bottoms: Thermoset decorative overlay.
- F. Colors, Patterns, and Finishes: As scheduled.
- G. Substrate: Plywood.
- H. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Sections cited for fabrication and in the same grade, as specified in Part 2 of this Section for type of woodwork involved
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- E. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- F. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.

3.3 ADJUSTING AND CLEANING

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

END OF SECTION 06 4020

SECTION 06 6116 - SOLID SURFACE MATERIAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes solid surface material fabricated into the following:
 - 1. Solid surface material shower surrounds.
- B. Related Sections include the following:
 - 1. Blocking and grounds are specified in Division 06 Section "Miscellaneous Carpentry".
 - 2. Sealants are specified in Division 07 Section "Sealants."
 - 3. Cement board backer for wall panels is specified in Division 09 Section "Gypsum Board."

1.2 ACTION SUBMITTALS

- A. Product Data: Indicate product description, fabrication information, and compliance with specified performance requirements.
- B. Shop Drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions, cutouts, and coordination requirements with adjacent work.
- C. Samples: Submit minimum 6" x 6" samples of selected colors and patterns. Where color is not specified, provide full range of manufacturer's available color samples for selection by Architect.

1.3 INFORMATIONAL SUBMITTALS

- A. Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project closeout documents.
- B. Fabricator's Certificate: Submit certificate from manufacturer stating that fabricator is certified by manufacturer for this work.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced and authorized by manufacturer for production of solid surface fabrications similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.

- B. Fire-Test-Response Characteristics: Provide materials with surface-burning characteristics as indicated below, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less

1.5 JOB CONDITIONS

- A. Do not deliver components to project site until areas are ready for installation. Store indoors.
- B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.
- C. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of work. However, allow for adjustments where taking of field measurements before fabrication might delay work.
- D. Coordination: Furnish inserts and anchorages which must be built into other work. Coordinate delivery with other work to avoid delay.

1.6 WARRANTY

- A. General: The special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Manufacturer's Warranty. The manufacturer warrants to the original purchaser for commercial use that the manufacturer will at its option repair or replace, without charge, such product if it fails due to a manufacturing defect during the first 10 years after initial installation.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. Adhesives, Sealants and Solid Surface Material: Use adhesives, sealants and solid surface material that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Adhesives and sealants shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements ".

2.2 SOLID SURFACE MATERIALS

- A. General: Provide materials which have been selected for surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are not acceptable.
- B. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ICPA SS-1.
 - 1. Thickness: 6 mm.
 - 2. Color and Pattern: As selected by Architect for each location.
 - a. Provide white color as selected by Architect for shower walls.
 - 3. Finish: Semigloss.
 - 4. Available Products: Provide one of the following:
 - a. Corian Solid Surface by DuPont Polymers
 - b. Avonite Surfaces Wet Wall by Arristech Surfaces.
 - c. Swanstone CrystalColors by the Swan Corp.
 - d. Wetwall Panels by Wilsonart LLC.

2.3 MISCELLANEOUS MATERIALS

- A. Joint Adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints with chemical bonding.
- B. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.4 FABRICATION

- A. General: All fabrications shall be made using solid surface material. Fabrications shall be adhesively jointed with no exposed seams and having edge details as indicated on drawings. No exposed fasteners shall be allowed.
- B. Factory fabricate components into single unit to sizes and shapes indicated, in accordance with approved shop drawings.
- C. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
- D. Provide factory cutouts for bowls, plumbing fittings and accessories as indicated on the drawings.
- E. Cut and finish component edges with clean, sharp returns. Route radii and contours to template. Repair or reject defective and inaccurate work.

- F. Shower Walls: Fabricate each wall surface from a single piece of solid surface material. Form panel edges with tongue and groove interlock or square edges per manufacturer's standard method. Comply with solid surfacing material manufacturer's recommendations for adhesives, sealers, fabrication, and finishing. Provide exposed edges with edge profile as per approved shop drawings. Provide all trims and sealants required for a complete, watertight shower wall installation.
- G. Allowable Tolerances
 - 1. Variation in component size: $\pm 1/8"$.
 - 2. Location of openings: $\pm 1/8"$ from indicated location.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surface to receive work and conditions under which work will be installed. Do not proceed with work until all unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install components plumb and level, scribed to adjacent finishes, in accordance with approved shop drawings and product installation data.
- B. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.
- C. Shower Wall: Install in compliance with manufacturer's recommendations to provide a complete, watertight shower wall installation.

3.3 ADJUST AND CLEAN

- A. Clean exposed surfaces using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period. Repair work or replace damaged work that cannot be repaired as required.
- B. Keep components and hands clean during installation. Remove adhesives, sealants, and other stains. Replace stained components.

END OF SECTION 06 6116

SECTION 07 1113 – BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Cold-applied, cut-back asphalt dampproofing for exterior wall locations.

1.2 ACTION SUBMITTALS

- A. Product data for each type of product specified, including data substantiating that materials comply with requirements for each dampproofing material specified. Include recommended method of application, recommended primer, number of coats, coverage or thickness, and recommended protection course..

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed bituminous dampproofing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Single-Source Responsibility: Obtain primary dampproofing materials and primers from one source and by a single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1.4 PROJECT CONDITIONS

- A. Substrate: Proceed with dampproofing only after substrate construction and penetrating work have been completed.
- B. Weather Limitations: Proceed with dampproofing only when existing and forecasted weather conditions will permit work to be performed according to manufacturer's recommendations and warranty requirements.

PART 2 - PRODUCTS

2.1 BITUMINOUS DAMPPROOFING

- A. Cold-Applied, Asphalt Emulsion Dampproofing: Asphalt-based emulsions recommended by the manufacturer for dampproofing use when applied according to the manufacturer's instructions.
 - 1. Semimastic Grade: Emulsified asphalt semimastic, prepared with mineral-colloid emulsifying agents and containing fibers other than asbestos, complying with ASTM D 1227, Type II, Class 1.

2. VOC Content: 24 g/l or less.
3. Basis of Design Product: Provide HE789 Fibered Asphalt Emulsion Dampproofing by Henry Company or one of the following:
 - a. Karnak 220 Fibered Emulsion Dampproofing; Karnak Chemical Corporation.
 - b. MasterSeal 615; Master Builders Solutions by BASF

2.2 MISCELLANEOUS MATERIALS

- A. Primer: Asphalt primer complying with ASTM D 41, for asphalt-based dampproofing.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer.
- B. Fill voids, seal joints, and apply bond breakers, if any, as recommended by prime materials manufacturer, with particular attention at construction joints.
- C. Install separate flashings and corner protection stripping, as recommended by prime materials manufacturer, where indicated to precede application of dampproofing. Comply with details shown and with manufacturer's recommendations. Pay particular attention to requirements at building expansion joints, if any.
- D. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work by masking or otherwise protecting adjoining work.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's recommendations except where more stringent requirements are indicated and where Project conditions require extra precautions to ensure satisfactory performance of work.
- B. Application: Apply dampproofing to the following surfaces.
 1. Foundation wall surfaces.
 2. Other locations indicated on the Drawings.

3.3 COLD-APPLIED, ASPHALT EMULSION DAMPPROOFING

- A. Semimastic Grade: Brush apply two coats of asphalt emulsion dampproofing, each at a rate of 2 to 3 gal./100 sq. ft. (1 L/sq. m), to produce a uniform, total dry-film thickness of not less than 30 mils (0.8 mm), unless otherwise directed by coating manufacturer. Allow to dry between coats.

3.4 CLEANING

- A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 1113

SECTION 07 1619 - METALLIC OXIDE WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes metal-oxide waterproofing for the following locations:
 - 1. Interior surfaces floors and walls of elevator pits.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for formwork, waterstops, and finishing concrete walls and slabs to receive waterproofing.

1.2 SUBMITTALS

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

1.3 JOB CONDITIONS

- A. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after concrete and masonry substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
- B. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F (4.4 deg C) or above during work and cure period and space is well ventilated and kept free of water.

1.4 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, signed by Applicator and countersigned by Contractor agreeing to repair or replace waterproofing that does not comply with requirements or that fails to perform as required, and to maintain watertight conditions within specified warranty period. Warranty includes responsibility for removing and replacing other work that conceals metal-oxide waterproofing. During warranty period, repairs and replacements required because of unusual weather phenomena and other events beyond Contractor's or Applicator's control shall be completed by Contractor or Applicator and paid for by Owner at prevailing rates.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the following:
 1. A-H-Metallic Waterproofing; Anti Hydro International, Inc.
 2. WEATHERPROOF Metal-Cote Metallic Waterproofing Treatment; FBC Chemical Corp.
 3. Metalcrete Waterproofing; Metalcrete Industries

2.2 MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
- B. Slurry-Coat Aggregate: ASTM C 144, sand.
- C. Trowel-Coat Aggregate: ASTM C 33, fine aggregate.
- D. Water: Potable.
- E. Metal-Oxide Compound: A product specifically formulated for waterproofing concrete and masonry substrates and weighing not less than 85 percent of pulverized cast iron, 3 to 7 percent of a chemical-oxidizing agent, and not more than 5 percent of iron oxide or more than 0.05 percent of oil and 1 percent of other foreign substances. Provide finely graded, pulverized cast iron with 100 percent passing a No. 20 (0.85-mm) sieve and 10 to 25 percent passing a No. 200 (0.075-mm) sieve.
- F. Calking: Lead wool saturated in a slurry of metal-oxide waterproofing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and other surfaces where waterproofing is to be applied with Applicator present, for compliance with requirements for surface preparation, cleaning, and other conditions affecting waterproofing performance.
 1. Proceed with application only after unsatisfactory conditions have been corrected.
 2. Begin waterproofing application only after unsatisfactory conditions have been corrected.
 3. Application of waterproofing indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Protect other work from damage or discoloration from metal-oxide waterproofing during application. Provide temporary enclosure to ensure adequate ambient temperatures and ventilation conditions for application.
- B. Stop active water leaks according to waterproofing manufacturer's written instructions.
- C. Schedule cleaning and coating application so dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.
- D. Surface Preparation of Concrete: Comply with waterproofing manufacturer's written instructions and requirements indicated below to ensure that waterproofing bonds to concrete surfaces. Clean concrete surfaces according to ASTM D 4258 by using one or a combination of procedures as needed to effectively remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, curing compounds, and form-release agents.
 - 1. Prepare scratch- and float-finished concrete by etching with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
 - 2. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
 - 3. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.
- E. Mask-off surfaces adjoining areas to receive waterproofing treatment where surface damage or discoloration might result from application of waterproofing. Do not allow metal-oxide waterproofing or metal-oxide compound to migrate into reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves, unless indicated to be filled with metal-oxide caulking.
- F. At cracks in concrete, remove loosened chips and cut square reveal approximately 1 inch (25 mm) deep.

3.3 APPLICATION

- A. General: Comply with waterproofing manufacturer's written instructions, unless more stringent requirements are indicated.
- B. Mix waterproofing components according to waterproofing manufacturer's written instructions.
- C. Pretreatment: Slush-coat reveals, depressions, cracks, and similar surface features with a thick-cream mixture of metal-oxide compound and water.
- D. Slush-coat entire surface of area to be waterproofed with a thick-cream mixture of metal-oxide compound and water. Apply by brush, exercising extreme care to work mix thoroughly into surfaces over entire area. Maintain in damp condition during a minimum

24-hour oxidation period before applying next coat. Continue curing until slush coat has oxidized to a uniform, brown color.

- E. Brush on uniform successive coats of slurry, proportioned with 2 cu. ft. (0.06 cu. m) of aggregate to one bag of portland cement to 10 to 15 lb (4.5 to 6.8 kg) of metal-oxide compound, and comply with waterproofing manufacturer's written instructions. Apply coats at 24-hour intervals with continuous moisture curing between coats, and provide longer curing times where necessary for coat to achieve uniform oxidation as shown by uniformity of color. Apply the number of coats necessary to provide a total, average, metal-oxide compound content, excluding compound used for grouting, of 30 lb/100 sq. ft. (1.46 kg/sq. m), but not less than two slurry coats.
- F. Waterproofing Treatment Extensions: Apply treatment to columns that are integral with walls to be treated, and extend treatment onto partition walls that intersect exterior walls, for a distance of 24 inches (600 mm) for cast-in-place concrete and 48 inches (1200 mm) for masonry partitions. Where floors (but not walls) are treated, extend treatment 12 inches (300 mm) high onto exterior walls and onto both exterior and interior columns. Unless otherwise indicated, extend treatment to every surface of substrate in area indicated for treatment, including stair treads and risers, pipe trenches, pipe chases, pits, sumps, and similar offsets and features.

3.4 PROTECTION

- A. Protect applied metal-oxide waterproofing and protective courses from rapid drying, severe weather exposure, and water accumulation. Maintain completed Work in moist condition for not less than seven days by covering with impervious sheeting or by other curing procedures recommended by waterproofing manufacturer.

END OF SECTION 07 1619

SECTION 07 2100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Mineral-wool board insulation.
3. Mineral-wool blanket insulation.

B. Related Sections:

1. Section 04 2213 "Brick Masonry Veneer" for insulation installed in cavity walls.
2. Section 07 5216 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing" for insulation specified as part of roofing construction.
3. Section 07 8446 "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.
4. Section 09 2900 "Gypsum Board" for installation of acoustical blankets in metal-framed assemblies.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.4 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.
- B. Vertical and Lateral Fire Propagation Test Characteristics: The exterior wall assembly is required to comply with NFPA 285 "Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components." The base wall, stud cavity insulation, wall sheathing, air barrier, continuous wall rigid insulation and exterior cladding are components that are required to be evaluated as part of this specific assembly test. Insulation shall be part of an assembly that has passed NFPA 285 testing.

1.5 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 before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation (Drawing Designation Type 1A): ASTM C 578, Type X, 15-psi (104-kPa) minimum compressive strength, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. DiversiFoam Products; CertaFoam 15.
 - b. DuPont; Dow Styrofoam Brand Cavitemate.
 - c. Owens Corning; Foamular CW15 Square Edge.
 - 2. Thickness: As indicated on Drawings for each application.
 - 3. R-Value per Inch: 5
 - 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- B. Geotextile-Faced, Extruded-Polystyrene Wall-Insulation Drainage Panels (Drawing Designation Type 1F): Board insulation meeting ASTM C 578, Type IV, 25-psi (173-kPa) minimum compressive strength, fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven geotextile filter fabric.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Owens Corning; Foamular Insul-Drain.
 - b. T. Clear Corp., a subsidiary of Fin Pan Inc.; ThermaDRY 750.
 - 2. Thickness: As indicated on Drawings for each application.
 - 3. R-Value per Inch: 5

2.2 MINERAL-WOOL BOARD INSULATION

- A. Insulation shall comply with the 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. Unfaced, Mineral-Wool Board Insulation (Drawing Designation Type 5A): ASTM C 612, Types 1A and 1B; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics; nominal density of 6 lb/cu. ft. (96 kg/cu. m)
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ROXUL; CAVITYROCK
 - b. Thermafiber; Thermafiber RainBarrier HD.
 - 2. Thickness: As indicated on Drawings for each application
 - 3. R-Value per Inch: 4.3

2.3 MINERAL-WOOL BLANKET INSULATION

- A. Insulation shall comply with the 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. Unfaced, Mineral-Wool Blanket Insulation (Drawing Designation Type 4A): ASTM C 665, Type 1 (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ROXUL; Comfortbatt
 - b. Thermafiber; UltraBatt
 - 2. Thickness: As indicated on Drawings for each application
 - 3. R-Value per Inch:
 - a. 2.5" Thick: 10
 - b. 3.5" Thick: 15
 - c. 6" Thick: 24
 - d. 7.25" Thick: 30
 - e. 8" Thick: 32

2.4 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
 - 1. Products: Subject to compliance with requirements, provide one of the following or equal:
 - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.

- b. Eckel Industries of Canada; Stic-Klip Type N Fasteners
 - c. Gemco; Spindle Type.
 - 2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
 - 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
- 1. Products: Subject to compliance with requirements, provide one of the following or equal:
 - a. Gemco; 90-Degree Insulation Hangers.
 - 2. Angle: Formed from 0.030-inch- (0.762-mm-) thick, perforated, galvanized carbon-steel sheet with each leg 2 inches (50 mm) square.
 - 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
- 1. Products: Subject to compliance with requirements, provide one of the following or equal:
 - a. AGM Industries, Inc.; RC150 or SC150.
 - b. Gemco; Dome-Cap, R-150 or S-150.
 - 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawl spaces.
 - b. Ceiling plenums.
 - c. Attic spaces.
 - d. Where indicated.
- D. Gas-Actuated Insulation Fasteners: Non-metallic insulation fastener assembly consisting of a plate or washer component formed from HDPE and a nail or pin component fabricated from zinc coated carbon steel pre-mounted in the plastic assembly, designed to be installed using a proprietary gas-actuated tool.
- 1. Products: Subject to compliance with requirements, provide one of the following or equal:
 - a. X-IE-G Insulation Fastening System by Hilti
 - b. Ramset-I-F System by ITW Commercial Construction

2.5 ACCESSORIES

- A. 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.
 - 1. Adhesives shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- 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. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions. Extend insulation to dimension below exterior grade line as indicated.
 - 1. Where below grade insulation is installed over drainage protection board and installed waterproofing membrane, install boards vertically, loose laid.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.4 INSTALLATION OF INSULATION FOR FRAMED AND FURRED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with

adhesive or use mechanical anchorage to provide permanent placement and support of units.

- B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Glass-Fiber or Mineral-Wool 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 (76-mm) 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 (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs. Install with required number of fasteners in accordance with manufacturer's recommendations.
 - 5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed toward interior of construction.
- D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Unfaced mineral wool insulation.

3.5 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches (1219 mm) up either side of partitions.

3.6 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

- A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
 - 2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.

3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.7 PROTECTION

- A. Protect installed insulation and vapor retarders 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

SECTION 07 2726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fluid-applied, vapor-permeable membrane air barriers.
- B. Related Requirements:
 - 1. Section 06 1643 "Gypsum Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.2 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review air-barrier requirements and installation, special details, mockups, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 2. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and field testing agency.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- D. Field test reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.
 - 1. Install fluid-applied membrane air barriers system on mockups of exterior wall systems specified in other specification sections to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier 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.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will Retain subparagraph below if the intention is to make an exception to the default requirement in Section 014000 "Quality Requirements" for demolishing and removing mockups.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.10 WARRANTY

- A. Manufacturer's Warranty: Submit manufacturer's standard warranty form for membrane systems, include affirmation of waterproofing mock-up observation and approval as required by warranty provisions. Approval by manufacturer for warranty is required prior to system application. Submit manufacturer's "Request Form" and supporting documentation at completion of waterproofing application through the local Authorized Distributor of the materials.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Installer's Warranty: Installer's standard form in which installer agrees to repair or replace membranes that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. Sealants and liquid applied air barriers shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".

2.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

- A. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa) when tested according to ASTM E 283, ASTM E 783, or ASTM E 2357.
- B. Vertical and Lateral Fire Propagation Test Characteristics: The exterior wall assembly is required to comply with NFPA 285 "Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components." The base wall, stud cavity insulation, wall sheathing, air barrier, continuous wall rigid insulation and exterior cladding are components that are required to be evaluated as part of this specific assembly test. Membrane air and moisture barriers shall be part of an assembly that has passed NFPA 285 testing.

2.3 HIGH-BUILD VAPOR-PERMEABLE MEMBRANE AIR BARRIER

- A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils (0.9 mm) or thicker over smooth, void-free substrates.
 - 1. Basis of Design Product: Provide ExoAir 230 by Tremco or one of the following:
 - a. GCP Applied Technologies: Perm-A-Barrier VPL.
 - b. Henry Company; Air-Bloc 17MR.
 - 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Minimum 10 perms (580 ng/Pa x s x sq. m); ASTM E 96/E 96M.
 - c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.

2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Counterflashing Strip: Modified bituminous, 40-mil- (1.0-mm-) thick, self-adhering sheet consisting of 32 mils (0.8 mm) of rubberized asphalt laminated to an 8-mil- (0.2-mm-) thick, cross-laminated polyethylene film with release liner backing.
- D. Butyl Strip: Vapor retarding, 30 to 40 mils (0.76 to 1.0 mm) thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.
- E. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.

- F. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- G. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- H. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft (24- to 32-kg/cu. m) density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer
- I. Modified Bituminous Transition Strip: Vapor retarding, 40 mils (1.0 mm) thick, smooth surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.
- J. Preformed Silicone Extrusion/Aluminum Receiver Transition Assembly: Manufacturer's standard system consisting of cured low-modulus silicone rubber extrusion, sized to fit opening widths, silicone rubber corners, extruded aluminum adaptor, sealant tape, and single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant designed for use as the transition assembly between window or wall system and adjacent air and moisture barrier materials.
 - 1. Basis of Design System: Provide Proglaze ETA – System 1 by Tremco or equal.
 - 2. System shall be approved by air and moisture barrier manufacturer for use with their membrane.
- K. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."
- L. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

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 substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
 - 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 - 1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches (75 mm) along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.
- B. Gypsum Sheathing: Fill joints greater than 1/4 inch (6 mm) with sealant according to ASTM C 1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

3.4 TRANSITION STRIP INSTALLATION

- A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 2. Install butyl strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Mechanically attach preformed silicone extrusion/aluminum receiver transition assembly to the structural framing of the wall opening so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.
1. Preformed Silicone Extrusion/Aluminum Receiver Transition Assembly: Install butyl tape sealant on wall opening framing to temporarily hold the aluminum adaptor in position and to form a secondary air and water seal. Mechanically fasten metal adaptor to framing. Install silicone rubber extrusions and corner units into receiver, locking into receiver. Install a full-bed of silicone sealant at perimeter of system to form a continuous wet seal. Comply with manufacturer's installation directions.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- I. Seal top of through-wall flashings to air barrier with an additional 6-inch- (150-mm-) wide, modified bituminous strip.

- J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

- A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- B. High-Build Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
 - 1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 35-mil (0.9-mm) dry film thickness, applied in one or more equal coats.
- C. Apply strip and transition strip a minimum of 1 inch (25 mm) onto cured air-barrier material or strip and transition strip over cured air-barrier material overlapping 3 inches (75 mm) onto each surface according to air-barrier manufacturer's written instructions.
 - 1. Install preformed silicone extrusion/aluminum receiver transition assembly over cured air and moisture barrier membrane at all wall openings including windows, doors, curtainwalls and other openings, as specified above.
- D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency:
 - 1. Owner will engage a Project Inspector to perform inspections.

2. Contractor shall engage a qualified testing agency to perform in-place testing on completed construction of air barrier installation on building.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Continuous structural support of air-barrier system has been provided.
 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 4. Site conditions for application temperature and dryness of substrates have been maintained.
 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 6. Surfaces have been primed, if applicable.
 7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 8. Termination mastic has been applied on cut edges.
 9. Strips and transition strips have been firmly adhered to substrate.
 10. Compatible materials have been used.
 11. Transitions at changes in direction and structural support at gaps have been provided.
 12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 13. All penetrations have been sealed.
- C. Testing: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on testing by a qualified testing agency. Perform the following tests:
1. Qualitative Air-Leakage Testing: Completed construction shall be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers or ASTM E 1186, chamber depressurization with detection liquids.
 2. Quantitative Air-Leakage Testing: Completed construction shall be tested for air leakage according to ASTM E 783.
- D. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient air-barrier components for retesting as specified above.

- E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- F. Prepare test reports.

3.7 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 07 2726

SECTION 07 4213.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concealed-fastener, lap-seam metal wall panels.
2. Metal wall panel accessories including closures, fasteners and clips, copings, fascia, sills, corners, flashings, and other components of wall panel system.
3. Wall panel sub-framing system.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal panel assembly during and after installation.
8. Review of procedures for repair of metal panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
2. Include data indicating compliance with performance requirements, including load span tables tested for side joint disengagement under negative loads per ASTM E 72.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
3. Indicate coordination dimensions related to structural support system elements provided by others.

C. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches (305 mm) long by actual panel width.
2. Copings, Trim and Other Closures: 12 inches (305 mm) long. Include fasteners and other exposed accessories

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Build mockup of typical in-place metal panel assembly of size and in location as directed by the Architect. Include including supports, attachments, and accessories. Demonstrate details of typical transitions to adjacent materials.
 2. Reprepare mockups as required to obtain Architect's approval.
 3. Do not proceed with installation of metal wall panels until Architect has approved mock-up.
 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. 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 soffits, 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. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. 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. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
- 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 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. Secondary Metal Framing: Design secondary metal framing for metal wall panel assembly according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 - 5. Side Joint Disengagement: Panels must be designed and tested under Negative load per ASTM E 72.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at a static test-pressure difference of 1.57 lbf/sq. ft. (75 Pa).
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at a minimum static test-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
- D. 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Vertical and Lateral Fire Propagation Test Characteristics: The exterior wall assembly is required to comply with NFPA 285 "Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components." The base wall, stud cavity insulation, wall sheathing, air barrier, continuous wall rigid insulation and exterior cladding are components that are required to be evaluated as part of this specific assembly test. Metal wall panels shall be part of an assembly that has passed NFPA 285 testing.

2.2 MANUFACTURERS

- A. Manufacturers: Basis-of-Design Products are manufactured by CENTRIA Architectural Systems. Subject to compliance with requirements, provide specified products or equal products by one of the following:
1. ATAS International, Inc.
 2. Fabral
 3. Firestone Metal Products
 4. Morin; a Kingspan Group company

2.3 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Metal Panel: Recessed-joint profile with raised flat pan.
1. Basis-of-Design Product: Profile Series IW Series Profile IW-40A manufactured by CENTRIA Architectural Systems; or approved equivalent.
 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M..
 - a. Thickness: 20 gauge (.91 mm)
 - b. Surface: Smooth, flat finish.
 - c. Exterior Finish: Three-coat fluoropolymer
 - d. Color: As selected by Architect from manufacturer's full range, and to match composite metal wall panels.
 3. Panel Coverage: 12 inches (305 mm).
 4. Panel Height: 1.50 inch (38 mm).
 5. Panel Appearance: 11" flat panel with 1" recess.
 6. Panel Orientation: Vertical.

2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- .
1. Hat Channels: 0.053 inch/16 ga. (1.34 mm) minimum.
 2. Sill Channels: 0.053 inch/16 ga. (1.34 mm) minimum.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings,

sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Extruded Trim: Manufacturer's complementary steel extrusions; provide for base only. Finish to match metal wall panels
1. Basis of Design: CENTRIA, Microline Extrusions
- E. 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.
- F. Concealed Clips: Galvanized steel, 0.051 inch/16 ga. (1.29 mm) thick, designed to allow unimpeded thermal movement of panel and configured to hold panel minimum 1/2 inch (12.7 mm) from substrate.
- G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated

performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

- B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel 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: 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. Steel Panels and Accessories:
 - 1. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754, approved shop drawings and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install 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. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use 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. 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 (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.
- E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel 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 sheet metal flashing and trim to fit substrates and achieve waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) 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 (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 4213.13

SECTION 07 4213.53 - COMPOSITE METAL WALL AND SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Metal-faced composite core wall panels used for soffits, fascia cladding, wall panels, window surrounds, and other applications.
2. Metal wall panel accessories including closures, fasteners and clips, corners, flashings, and other components of wall panel system.
3. Wall panel stub framing system.
 - a. Subframing required to support the composite core wall panel profiles indicated on the Drawings shall be part of the system designed under this Section.

B. Related Sections include the following:

1. Division 05 Section "Cold-Formed Metal Framing" for secondary support framing supporting metal panels.
2. Division 07 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment systems, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. Include structural data indicating compliance with performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Indicate coordination dimensions related to structural support system elements provided by others.

C. Samples for Initial Selection:

1. Include Samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view

- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
1. Metal Panels: 12 inches (300 mm) long by actual panel width. Include fasteners, clips, closures, and other metal panel accessories.
 2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 3. Sealants: 12 inches (300 mm) long strips of cured sealants showing the colors to be provided for each sealant exposed to view

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Maintenance Data: For metal panels to include in maintenance manuals.
- C. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of metal panels through one source from a single manufacturer.
- C. Mockups: Prior to installing metal wall panels, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for Work.
1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
 2. Include exposed sealant joint in mock-up.
 3. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Obtain Architect's approval of mockups before start of Work.
 6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
- D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the 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 metal wall panel systems including secondary framing that are similar to those indicated for this Project in material, design, and extent.

- E. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact joint sealants to joint-sealant manufacturers for testing indicated in subparagraphs below:
 - 1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - a. Perform tests under environmental conditions replicating those that will exist during installation.
 - 2. Submit no fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Protect strippable protective covering on metal panels from exposure to sunlight and high humidity, except to extent necessary for period of metal panel installation.

1.6 PROJECT 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.
- B. Field Measurements: Verify locations of framing dimensions by field measurements before metal panel fabrication and indicate measurements on Shop Drawings.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal 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 rupturing, cracking, or puncturing.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. 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 wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Provide metal panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.
- B. Thermal Movements: Provide metal panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:
1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) for metal-faced composite core wall panels.
- D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa) for metal-faced composite core wall panels.
- E. Structural Performance: Metal wall panel assemblies shall withstand the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure as indicated on Structural Drawings.
 2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than the following
 - a. 1/175 of the span at the perimeter and 1/60 of the span anywhere in the panel for metal-faced composite core wall panels.
 3. Secondary Framing: Design secondary framing system according to AISI "Standard for Cold-Formed Steel Framing - General Provisions."
- F. Vertical and Lateral Fire Propagation Test Characteristics: The exterior wall assembly is required to comply with NFPA 285 "Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components." The base wall, stud cavity insulation, wall sheathing, air barrier, continuous wall rigid insulation and exterior cladding are components that are required to be to be evaluated as part of this specific assembly test. Metal wall and soffit panels shall be part of an assembly that has passed NFPA 285 testing.

2.2 PANEL MATERIALS

- A. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

2.3 MISCELLANEOUS METAL FRAMING

- A. Steel Sheet Components, General: Complying with ASTM C 645 requirements for metal and with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
- B. Subgirts: C- or Z-shaped sections fabricated from 0.0598-inch (1.5-mm) bare steel thickness, shop-painted, cold-formed, metallic-coated steel sheet.
- C. Base or Sill Angles and Channels: 0.079-inch (2.0-mm) bare steel thickness, cold-formed, galvanized steel sheet.
- D. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
 2. Depth: 7/8 inch (22 mm) unless otherwise indicated.

- E. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (13-mm-) wide flange.
 - 1. Depth: As indicated.
- F. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0312 inch (0.79 mm).
- G. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
- H. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.4 MISCELLANEOUS MATERIALS

- A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating.
 - 1. Fasteners for Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.

2.5 METAL-FACED COMPOSITE CORE WALL AND SOFFIT PANELS

- A. General: Provide factory-formed and -assembled, metal-faced composite panels fabricated from two metal facings bonded, using no glues or adhesives, to solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system. Metal composite panel system shall be a full system that includes the sub-framing designed by system supplier's professional engineer.
 - 1. Surface-Burning Performance: Product shall have the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Basis of Design Product: Provide Alucobond PLUS manufactured by 3A composites USA or equal products of one of the following:
 - a. Arconic Architectural Products (USA).
 - b. Mitsubishi Chemical Composites.
- B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- (0.50-mm-) thick, coil-coated aluminum sheet facings.
 - 1. Panel Thickness: 4 mm.

2. Core: Fire retardant core.
3. Exterior Finish: Three-coat fluoropolymer. AAMA 620/621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color: As selected by Architect from manufacturer's full range, and to match formed metal wall panels.

C. Attachment System Components: Formed from extruded aluminum.

1. Include manufacturer's standard perimeter extrusions with integral weather stripping, panel stiffeners, panel clips and anchor channels as indicated or as required for a complete assembly.

D. System Installation Method: Rout and return wet seal.

E. Applications: Soffits, fascia, wall cladding, trim, and other articulated exterior metal wall panels, and other applications indicated on Drawings.

F. Flashing and Trim Color: Same material, finish, and color as facings of adjacent panels

2.6 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

2.7 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory to greatest extent possible, 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. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals
- C. Metal-Faced Composite Wall Panels: Factory form panels in a continuous process with no glues or adhesives between dissimilar materials. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.
1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
 2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
 3. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
 4. Dimensional Tolerances:
 - a. Panel Bow: 0.8 percent maximum of panel length or width.

- b. Squareness: 0.25 inch (5 mm) maximum.
- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the 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. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 - 3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application but not less than thickness of metal being secured.

2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted 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 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of work.
- B. Examine primary and secondary framing to verify that structural panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 - 1. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before metal panel installation

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous panel support members and anchorage according to metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION, GENERAL

- A. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Factory cut metal panels as required for penetrations and openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by saw or torch is not permitted.
 - 2. Install metal panels perpendicular to structural supports, unless otherwise indicated.
 - 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal panel manufacturer.
- C. Joint Sealers: Install sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal panel manufacturer.

3.4 METAL WALL AND SOFFIT PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Anchor metal wall 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 wall panels.
 - 2. Install flashing and trim as metal wall panel work proceeds.
- B. Clip Installation: Attach panel clips to supports at each metal-faced composite wall panel joint at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-turned flanges of wall panels to panel clips with manufacturer's standard fasteners.
 - 1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants."

2. Install semi-rigid mineral wool between subframing for the clip installation system where indicated.
- C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 4213.53

SECTION 07 4636 - SOLID COMPOSITE ARCHITECTURAL WALL/SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior solid phenolic wall panel system (Composite Wood Panel Designation CWP) used for cladding walls and soffits
2. Metal subframe and furring members.
 - a. Subframing required to support the composite wood wall panel profiles indicated on the Drawings shall be part of the system designed under this Section.
3. Concealed fasteners, hanging hooks and clips.

B. Related Sections Include the Following:

1. Division 07 Section "Fluid Applied Membrane Air Barriers" for weather barrier on gypsum sheathing behind phenolic wall panels.
2. Division 07 Section "Sheet Metal Flashing and Trim" for items made of formed metal for flashing purposes.

1.2 ACTION SUBMITTALS

A. Product Data: Include manufacturer's product specifications, standard details, certified product test results, and general recommendations, as applicable to materials and finishes for each component and for total panel assemblies.

B. Shop Drawings: Show panel layout, profiles, attachments and product components, subframing system, including the following:

1. Edge conditions.
2. Panel joints.
3. Anchorage, including manufacturer's metal subframe system components.
4. Accessories.
5. Concealed-fastening locations.
6. Finishes, colors, and textures, including veneer orientation.
7. Panel sizes and layouts on building elevations.
8. Include structural data indicating compliance with performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
9. Indicate coordination dimensions related to structural support system elements provided by others.

- C. Samples for Verification: Provide sample panels 12-inches (300 mm) long by actual panel width, in the profile, style, color, and texture indicated. Include panel accessories and fasteners..

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- B. Qualification Certificates: Certificate indicating compliance with qualification requirements in Quality Assurance Article.
- C. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria, and physical requirements.
- D. Operation and Maintenance Data: Submit operation and maintenance data for installed products in accordance with Division 01 Section "Closeout Procedures." Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer, approved by the manufacturer, who has completed composite panel projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Manufacturer Qualifications: Manufacturer producing product in ISO 9001 certified facility, capable of providing service representation during fabrication and approving application method.
 - 1. Obtain fabrications through one source from a single manufacturer.
- C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the 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 metal wall panel systems including secondary framing that are similar to those indicated for this Project in material, design, and extent.
- D. Mockups: Before installing composite panels, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using exposed and concealed materials indicated for the completed Work.
 - 1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven (7) days in advance of the dates and times when mockups will be constructed.

3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before proceeding with construction of wall panels.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - a. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work..

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver composite panels and other components so they will not be damaged or deformed. Package panels for protection against damage during transportation or handling.
- B. Handling: Exercise care in unloading, storing, and erecting composite panels to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight and ventilated covering. Store panels to ensure dryness. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Warranty: Submit a written warranty, signed by manufacturer, agreeing to repair finish or replace wall panels that show evidence of deterioration. Deterioration of finish includes, but is not limited to, color fade, chalking, cracking, peeling, and loss of panel integrity.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Provide panels complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement, and exposure to weather without failure or infiltration of water into the building interior.
- B. Surface- Burning Characteristics: Provide composite wall panels having materials with the following surface-burning characteristics as determined by testing identical products in accordance with E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Flame-Spread Index: 5 or less (Type I, Class A).
 - 2. Smoke-Developed Index: 5 or less.
- C. Structural Performance: Provide composite wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592 or ASTM E 330:
 - 1. Wind Loads: Resist wind positive and negative pressures calculated according to the New York Building Code Section 1609.6 "Simplified Provisions for Low-Rise Buildings."
 - a. Basic Wind Speed: As indicated on Structural Drawings.
 - b. Wind Load Importance Factor: As indicated on Structural Drawings
 - c. Wind Speed Category: As indicated on Structural Drawings.
 - 2. Deflection Limits: Engineer composite wall panel assemblies to withstand test pressures with deflection no greater than 1/180 of the span and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span.
 - a. Test Pressures: 150 percent of inward and outward wind-load design pressures.
- D. Thermal Movement: Completed composite panels, subframing and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing stress on structure, anchors or fasteners, or reducing performance ability. Provide composite wall panel assemblies that allow for noiseless thermal movements resulting from the following range in ambient temperatures and that prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects:
 - 1. Ambient Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
- E. Thermal Performance of Subframing System:
 - 1. Attachment system must be thermally modeled to demonstrate, at minimum, a compliance with ANSI/ASHRAE 90.1-2010 maximum U-Value for walls.
 - 2. Continuous framing profiles (including C- or Z-shaped sections or furring) penetrating insulation are not permitted.

- F. Vertical and Lateral Fire Propagation Test Characteristics: The exterior wall assembly is required to comply with NFPA 285 "Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components." The base wall, stud cavity insulation, wall sheathing, air barrier, continuous wall rigid insulation and exterior cladding are components that are required to be evaluated as part of this specific assembly test. All products of the solid phenolic wall panel system, including subframing, shall be part of an assembly that has passed NFPA 285 testing.

2.2 SOLID PHENOLIC WALL PANELS

- A. General: Provide solid phenolic flat panels based on thermosetting resins, homogeneously reinforced with cellulose fibers and manufactured under high pressure and temperature. The panels shall be clad in wood veneer with a surface treated with synthetic resin and an exterior PVDF film.
1. Provide panels free from surface blemishes where exposed to view in finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.
- B. Basis of Design Product: Provide Prodex IGN panels manufactured by Prodema USA, Inc. or equal.
1. Color: Pale.
 2. Panel Standard Size: 48" x 96"
 3. Panel Thickness:
 - a. Wall Cladding: 9/16" (14 mm)
 - b. Soffit Cladding: 1/2" (12 mm)
 4. Joints Between Panels: Provide a black back filler material to cover the open joints when panels are installed.
 5. Installation Method: Concealed fastening using horizontal guide rails and hanging hooks, as indicated on Drawings.

2.3 ACCESSORIES

- A. General: Provide components required for a complete solid phenolic panel assembly including trim, copings, fascia, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.
- B. Concealed Fastening Hanging System: Provide panel manufacturer's standard aluminum sub-frame system consisting of horizontal guide rails and adjustable, hanging aluminum brackets.
1. Finish of Guide Rails: As selected by Architect.

- C. Fasteners: Stainless Steel, 300 Series fasteners; type as required to suit project conditions.

2.4 ALUMINUM VERTICAL SUBFRAMING SYSTEM

- A. Provide a non-continuous, aluminum rain screen attachment system for attachment of siding panels, installed in conjunction with exterior insulation, with non-continuous, self-shimming bracket and rail assembly to accommodate out of plumb conditions.
 - 1. Bracket and rail components shall be fabricated from 6063-T6 aluminum extrusions with mill finish.
 - 2. Brackets shall have minimum 1-1/2" of adjustability.
 - 3. Basis of Design Product: Alpha Vci system consisting of Alpha V Wall Bracket and L-Shaped vertical rails, manufactured by ECO Cladding, or equal.

2.5 FABRICATION

- A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible, 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.
 - 1. Form panels to specified dimensions with tolerances to accommodate expansion and contraction between panels and structural members.
- B. Fabricate solid phenolic wall panels and accessory items in accordance with manufacturer's recommendations and approved submittals.
- C. Factory fabricate accessory and trim components ready for installation. Fabricate panels to profile indicated.
- D. Maximum allowable panel tolerances:
 - 1. Panel bow: 0.2% of panel dimensions in width and length up to 0.1875 inches (4.76 mm) maximum.
 - 2. Width or length: +/-0.032 inch (0.8mm) up to 48 inches (1219mm) +/-0.064 inches (1.6mm) from 48 inches (1219mm) to 144 inches (3658mm).
 - 3. Thickness: +/-0.008 inches (0.2mm).
 - 4. Squareness: 0.1875 inches (4.76mm) difference between diagonal measurements.
 - 5. Camber: 0.32 inches (0.8mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements indicated for conditions affecting performance of solid phenolic panel walls.

1. Panel Supports and Anchorage: Examine wall framing to verify that angles, and other secondary structural panel support members and anchorage have been installed to meet requirements of panel manufacturer.
2. Do not proceed with wall panel installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate wall panels with construction of roofing, walls, including glazed curtainwalls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.
- B. Promptly remove protective film, if any, from exposed surfaces of wall panels. Strip with care to avoid damage to finish.
- C. Sort panels for color variation

3.3 ALUMINUM VERTICAL SUBFRAMING SYSTEM INSTALLATION

- A. Install rainscreen attachment system in accordance with manufacturer's instructions and approved shop drawings.
- B. Attach brackets and vertical support rails with engineered fasteners to meet performance criteria specified.

3.4 PANEL INSTALLATION

- A. General: Comply with panel manufacturer's written instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Install wall panels plumb and level, and accurately spaced in accordance with manufacturer's recommendations and approved submittals.
 2. Locate concealed fasteners in accordance with approved shop drawings
 3. Install manufacturer's metal sub-frame system horizontal rails and adjustable, hanging aluminum brackets in accordance with manufacturer's directions. Adjust panels for accurate spacing of panel joints before fastening in place.
- B. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4-inch in 20-feet (6 mm in 6 m) on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING AND PROTECTING

- A. Damaged Units: Replace panels and other components of the Work that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

- B. Cleaning: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.

END OF SECTION 07 4636

SECTION 07 5216 - STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing, 2 ply, cold adhesive applied.
2. Vapor retarder.
3. Roof insulation.
4. Cover board.
5. Substrate board.
6. Walkway pads.
7. Electronic leak detection (ELD) materials.

B. Related Requirements:

1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking, and for wood-based, structural-use roof deck panels.
2. Section 07 6200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 07 9200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

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. Preinstallation Roofing Conference:** Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.
2. Include Electronic leak detection (ELD) materials.

B. Shop Drawings: Include plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation, including slopes.
5. Crickets, saddles, and tapered edge strips, including slopes.
6. Insulation and substrate board fastening patterns for corner, perimeter, and field-of-roof locations.
7. Layout and locations of walkways.

C. Samples for Verification: For the following products:

1. Cap Sheet: Samples of manufacturer's standard colors for selection by Architect.
2. Flashing Sheet: Samples of manufacturer's standard colors for selection by Architect.

D. 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. Product Test Reports: For roof membrane and insulation, tests performed by a qualified testing agency, indicating compliance with specified requirements.
- D. Evaluation Reports: For components of membrane roofing system, from ICC-ES.
- E. Field quality-control reports.
- F. Field test reports.
- G. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.
- B. 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.
- C. Electronic Leak Detection Testing: ELD testing shall comply with ASTM Standard Practice D8231 "Standard Practice for the Use of a Low Voltage Electronic Scanning Platform for Detecting and Locating Breaches in Roofing and Waterproofing Membranes."

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.

1. Protect stored liquid material from direct sunlight.
 2. 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.
1. Store in a dry location.
 2. 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 roof membrane, base flashings, roof insulation, fasteners, cover boards, vapor retarder, and other components of roofing system.
 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, and vapor retarders for the following warranty period:
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and 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. Roof system 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/D 3746M, ASTM D 4272/D 4272M, 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. Wind Uplift Resistance: Provide membrane roofing system that is identical to systems that have been successfully tested according to FM Approvals 4474, UL 580, or UL 1897 to resist the following uplift pressure calculated according to ASCE/SEI 7:
 1. Zone 1 (Roof Area Field): As indicated on Structural Drawings.
 2. Zone 2 (Roof Area Perimeter): As indicated on Structural Drawings.
 - a. Location: From roof edge to distance inside roof edge as indicated on Structural Drawings.
 3. Zone 3 (Roof Area Corners): As indicated on Structural Drawings.
 - a. Location: Distance in each direction from building corner as indicated on Structural Drawings.
- 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.
 1. Identify products with appropriate markings of applicable testing agency.
- E. Solar Reflectance Index (SRI): Three-year-aged SRI not less than 64 or initial SRI not less than 82 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- F. Adhesives and sealants shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".

2.2 MANUFACTURERS

- A. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturer approved by roof membrane manufacturer.
- B. Basis of Design Manufacturer: Provide products of Siplast or equal products of Johns Manville or GAF.

2.3 BASE SHEET MATERIALS

- A. SBS-Modified Bitumen Fiberglass Mat Base Sheet: ASTM D 6163/D 6163M, Type I, Grade S, SBS-modified asphalt sheet, reinforced with fiberglass fabric, smooth surfaced, suitable for cold adhesive application method.

1. Basis of Design Product: Paradiene 20 by Siplast, or equal.

2.4 STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS CAP SHEET

- A. Granule-Surfaced Roofing Cap Sheet: ASTM D 6163/D 6163M, Type I, Grade G, SBS-modified asphalt sheet, reinforced with fiberglass fabric, suitable for cold adhesive application method.

1. Granule Color: Bright White; ceramic granules specially treated for cool roof applications.
2. Basis of Design Product: Paradiene 30 FR BW by Siplast, or equal

2.5 BASE FLASHING SHEET MATERIALS

- A. Backer Sheet: ASTM D 6163/D 6163M, Type I, Grade S, SBS-modified asphalt sheet, reinforced with glass fibers smooth surfaced, suitable for cold adhesive application method.

1. Basis of Design Product: Paradiene 20 by Siplast, or equal

- B. Granule-Surfaced Flashing Sheet: ASTM D 6163/D 6163M, Type II, Grade G, SBS-modified asphalt sheet, reinforced with glass fibers, granule surfaced, suitable for cold adhesive application method.

1. Granule Color: Bright White; ceramic granules specially treated for cool roof applications.
2. Basis of Design Product: Paradiene 40 FR BW by Siplast, or equal.

2.6 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.

- B. Membrane Cold Adhesive: An asphalt, solvent blend conforming to ASTM D 4479, Type II requirements.

1. Basis of Design Product: Siplast PA-311 Adhesive by Siplast

- C. Flashing Adhesive: A single-component, modified adhesive. The adhesive blend shall be formulated in a grade for application of flashing materials.

1. Basis of Design Product: SFT Cement by Siplast

- D. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- F. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.
- G. Primer: Type recommended by roof membrane manufacturer.
- H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.
- I. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.
- J. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum board or ASTM C 1278/C 1278M, fiber-reinforced gypsum board.
 - 1. Thickness: 1/2 inch.
 - 2. Surface Finish: Unprimed
 - 3. Basis of Design Product: Dens Deck by Georgia Pacific, or equal
- K. Walktread: A prefabricated, puncture resistant polyester core reinforced, polymer modified bitumen sheet material topped with a ceramic-coated granule wearing surface.
 - 1. Thickness: 0.217 in (5.5 mm)
 - 2. Weight: 1.8 lb/ft² (8.8 kg/m²)
 - 3. Width: 30 in (76.2 cm)
 - 4. Basis of Design Product: Paratread by Siplast

2.7 VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: ASTM D 1970/D 1970M polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil- (1.0-mm-) total thickness; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

2.8 ROOF INSULATION

- A. General: Preformed roof insulation boards, manufactured or approved by roof membrane manufacturer, approved for use in FM Approvals' RoofNav listed roofing system identical to that used for this Project.
- B. Polyisocyanurate Board Insulation (Type 2B): 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. Size: 48 by 48 inches.
3. Thickness: As indicated on Drawings.
4. R-Value per Inch: 5.7
5. Basis of Design Product: Paratherm by Siplast

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation .
2. Minimum Thickness: 1/4 inch.
3. Slope: As indicated on Drawings
4. Basis of Design Product: Tapered Paratherm by Siplast

2.9 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. 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.
- C. Insulation Adhesive: A single component, moisture cured, polyurethane foam adhesive, dispensed from a portable, pre-pressurized container used to adhere insulation panels to the substrate, as well as to other insulation panels.
1. Basis of Design Product: Para-Stik Insulation Adhesive by Siplast
- D. Insulation Adhesive: A dual component, polyurethane foam adhesive used to adhere insulation panels to the substrate, as well as to other insulation panels.
1. Basis of Design Product: Parafast Insulation Adhesive by Siplast
- E. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.
- F. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum board or ASTM C 1278/C 1278M, fiber-reinforced gypsum board.
1. Thickness: 1/2 inch.
 2. Surface Finish: Unprimed
 3. Basis of Design Product: Dens Deck by Georgia Pacific, or equal.

2.10 ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Conductive Medium: Materials providing less than 10^4 ohms per square as determined in accordance with ASTM D4496 and approved by roofing membrane manufacturer.

1. Electrically Conductive Primer: Water-based, nonflammable, nonmetallic, low-VOC primer, UL listed and FM Global approved.
 - a. Basis of Design Product: TruGround Conductive Primer by Detec Systems or an approved equal.

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 cants, 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 053100 "Steel Decking."
 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 5. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer, when tested according to ASTM F 2170.
 6. Verify that concrete-curing compounds that impair adhesion of roofing components to roof deck have been removed.
 7. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions.
 1. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.
 1. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav 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 the end of the workday or when rain is forecast.
- C. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 INSTALLATION OF SUBSTRATE BOARDS

- A. Install substrate boards over metal decking with long joints in continuous straight lines, with end joints staggered between rows.
 - 1. Trim substrate board neatly to fit around penetrations and projections, and to fit tight to intersecting walls.
 - 2. At internal roof drains, conform to slope of drain sump. Trim substrate board, so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 4. Mechanically attach the substrate boards, using the specified fasteners, at the fastening rate that will meet the minimum wind uplift requirement at each defined zone.

3.5 VAPOR RETARDER INSTALLATION

- A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches (90 and 150 mm), respectively.
 - 1. Extend vertically up parapet walls and projections to a minimum height equal to height of the insulation and cover board.
 - 2. Seal laps by rolling.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSULATION INSTALLATION

- A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

- C. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing system with vertical surfaces or angle changes greater than 45 deg F (14 deg C).
- D. Installation Over Concrete Decks and Metal Decks:
 - 1. General:
 - a. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - b. 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 (600 mm).
 - 1) Trim insulation, so that water flow is unrestricted.
 - c. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - d. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
 - 2. Install base layer of insulation with joints staggered not less than 24 inches (600 mm) in adjacent rows
 - a. Metal Decks: Mechanically attach base layer of insulation over substrate board using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
 - b. Concrete Decks: Mechanically attach base layer of insulation to concrete deck over vapor retarder using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to concrete decks.
 - c. Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
 - 3. Install upper layers of insulation and tapered insulation, with joints of each layer offset not less than 12 inches (300 mm) from previous layer of insulation.
 - a. Stagger end joints within each layer not less than 24 inches (600 mm) in adjacent rows.
 - b. Adhere each upper layer of insulation to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
 - 1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 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 (150 mm) 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 FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
 - a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.8 INSTALLATION OF ELD COMPONENTS

- A. Install conductive medium over cover board and on vertical locations to receive roofing membrane in accordance with manufacturer's written installation instructions.

3.9 ROOFING MEMBRANE INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
 2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
 3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.10 MEMBRANE INSTALLATION

- A. Before installing, unroll finish ply sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature at which finish ply sheet will be installed.
- B. Membrane Adhesive Application: Apply cold adhesive by roller, squeegee or spray unit in a smooth, even, continuous layer without breaks or voids. Utilize an application rate of 2 to 2 1/2 gal/sq (0.6 to 1.0 l/m²) over irregular or porous substrates. Utilize an application rate of 1 1/2 to 2 gal/sq (0.6 to 0.8 kg/m²) for interply applications. Double the adhesive application rate at the end laps of granule surfaced sheets.

- C. Installation SBS-Modified Fiberglass-Mat Base and Finish Plies: Apply all layers of roofing free of wrinkles, creases or fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets.
1. Install plies according to roofing manufacturer's written instructions, starting at low point of roofing system.
 2. Apply all layers of membrane perpendicular to the slope of the deck.
 3. Install sheets in a shingle fashion.
 4. Fully bond the base ply to the prepared substrate, utilizing a minimum 3 inch side and end laps. Apply each sheet directly behind the adhesive applicator. Cut a dog ear angle at the end laps on overlapping selvage edges. Using a clean trowel, apply top pressure to top seal T-laps immediately following sheet application. Stagger end laps a minimum of 3 feet
 5. Fully bond the finish ply to the base ply, utilizing a minimum of 3-inch side and end laps. Apply each sheet directly behind the adhesive applicator. Stagger end laps of the finish ply a minimum of 3 feet. Cut a dog ear angle at the end laps on overlapping selvage edges. Using a clean trowel, apply top pressure to top seal T-laps immediately following sheet application. Stagger side laps of the finish ply a minimum 12 inches from side laps in the underlying base ply. Stagger end laps of the finish ply a minimum 3 feet from end laps in the underlying base ply.
 6. Heat weld all side and end laps of the modified bitumen plies during each day's application in areas where standing water accumulates.
 7. Install sheets without wrinkles, tears, and free from air pockets.
 8. Repair tears and voids in laps and lapped seams not completely sealed.
 9. Maximum sheet lengths and special fastening of the specified roof membrane system may be required at various slope increments where the roof deck slope exceeds 1/2 inch per foot. The manufacturer shall provide acceptable sheet lengths and the required fastening schedule for all roofing sheet applications to applicable roof slopes.

3.11 FLASHING AND STRIPPING INSTALLATION

- A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
1. Prime substrates if required by roofing system manufacturer.
 2. Backer Sheet Application:
 - a. Adhere backer sheet to substrate in cold-applied adhesive.
 - b. Seal all laps.
 3. Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.
- B. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.
- C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

- D. Roof Drains: Set 30-by-30-inch- (760-by-760-mm-) 4-pound (1.8 kg) lead flashing in bed of asphaltic adhesive on completed roofing membrane.
 - 1. Cover lead flashing with roofing cap-sheet stripping, and extend a minimum of 6 inches (150 mm) beyond edge of metal flashing onto field of roofing membrane.
 - 2. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.

3.12 WALKWAY INSTALLATION

- A. Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions. Allow 2 inch space between panels.
 - 1. Install walkways in a path from each roof access point to rooftop equipment and at the perimeter of all rooftop equipment.

3.13 FIELD TESTS AND INSPECTIONS

- A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Perform the following tests:
 - 1. Low-Voltage ELD Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roof membrane using horizontal membrane scanning platform and vertical membrane scanning in accordance with ASTM D8231.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
- C. 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.
 - 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

E. Roofing system will be considered defective if it does not pass tests and inspections.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.14 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

1. When remaining construction does not affect or endanger roofing, 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.

3.15 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: **<Insert name of Owner>**.
2. Address: **<Insert address>**.
3. Building Name/Type: **<Insert information>**.
4. Address: **<Insert address>**.
5. Area of Work: **<Insert information>**.
6. Acceptance Date: _____.
7. Warranty Period: **<Insert time>**.
8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding the mph rating as per the manufacturer's warranty;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract

Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 5216

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes sheet metal flashing and trim in the following categories:

1. Metal flashing.
2. Reglets.
3. Copings.
4. Scuppers.
5. Fascia
6. Metal trim.

1.2 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated 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. Low-slope membrane roof system metal edge securement, except gutters, shall be designed and installed for wind loads in accordance with Building Code of NY, Chapter 16 and tested for resistance in accordance with ANSI/SPRI ES-1.
1. Fabricate and install roof edge flashing, metal edge securement, facae and copings capable of resisting the following forces:
 - a. Wind Zone 2 (roof edge perimeter, vertical load direction): As indicated on Structural Drawings.
 - b. Wind Zone 3 (roof edge corners, vertical load direction): As indicated on Structural Drawings.
 - c. Wind Zone 4 (wall edge perimeter, horizontal load direction): As indicated on Structural Drawings.
 - d. Wind Zone 5 (wall edge corners, horizontal load direction): As indicated on Structural Drawings.
 2. Dimension of perimeter and corner zones shall be as indicated on Structural Drawings.
- C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces

1.3 ACTION SUBMITTALS

- A. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.
- B. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.
- C. Samples for Verification: Samples of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.
 1. 8-inch- (200-mm-) square Samples of specified sheet materials to be exposed as finished surfaces.
 2. 12-inch- (300-mm-) long samples of factory-fabricated products exposed as finished Work and accessories, as specified below.
 - a. Copings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.
- C. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.6 PROJECT CONDITIONS

- A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

1.7 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- B. Performance Warranty: Include copings, fasciae and roof edge flashings in Total System Warranty provided by roofing membrane manufacturer; refer to Section 075216.

PART 2 - PRODUCTS

2.1 METALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below:
 - 1. Aluminum Sheet: ASTM B 209, Alclad 3003-H14, with a minimum thickness as indicated.
 - 2. Extruded Aluminum: ASTM B 221, alloy 6063-T52, with a minimum thickness of 0.080 inch for primary legs of extrusions, unless otherwise indicated.
- B. Stainless Steel: ASTM 240/A 240M, Type 304 sheet.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
- B. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coat.

- C. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- D. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 07 Section "Joint Sealants."
- E. Epoxy Seam Sealer: 2-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints.
- F. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.
- G. Felt Underlayment: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- H. Slip Sheet: 3-lb. rosin-sized building paper or Tyvek by DuPont.
- I. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40 mils (1.0 mm) thick; slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Product: Ice and Water Shield by GCP Applied Technologies or equal.
- J. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.
- K. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.

2.3 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. General: Provide items designed and fabricated to fit applications indicated and to perform optimally with respect to weather resistance, water tightness, durability, strength, and uniform appearance.
- B. Expansion Provisions: Fabricate running lengths to allow controlled expansion not only for movement of metal components in relationship to one another but also to adjoining dissimilar materials, including flashing and roofing membrane materials, in a manner sufficient to prevent water leakage, deformation or damage.
- C. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.

1. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 2. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 3. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
 4. 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 Drawings show reglet without metal counterflashing.
 5. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.
 6. Material: Fabricate reglets from the following metal, in thickness indicated:
 - a. Stainless steel, 0.020 inch thick.
 7. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corporation.
 - b. Metal-Era Inc
 - c. Hickman Edge Systems.
- D. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.
1. Basis of Design Product: Permasnap Series Coping manufactured by Hickman Edge Systems or equal product of one of the following:
 - a. Metal-Era Inc.; "Perma-Tite" series
 - b. Petersen Aluminum; "PAC-Tite" series
 2. Coping-Cap Material: Formed aluminum, 0.050 inch (1.27 mm) thick.
 - a. Finish: Three-coat fluoropolymer, color as selected by Architect.
 3. Corners: Factory mitered and continuously welded
 4. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material .
 5. Snap-on-Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.
 6. Vertical Face and Back Leg Heights: As indicated on Drawings for each location.
 7. Warranty: Minimum 20 Year, 120 mph Wind Warranty
 8. Performance Criteria: Meeting project specific requirements in compliance with ANSI/SPRI/FM 4435/ES-1.

2.4 FABRICATION, GENERAL

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and

weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

- B. Seams in Aluminum: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- C. Expansion Provisions: Space movement joints at maximum of 10 feet with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25.4 mm) deep, filled with mastic sealant (concealed within joints.)
- D. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- E. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.
- F. Conceal fasteners and expansion provisions unless noted otherwise. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
- G. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
 - 1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.
- H. Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof.

2.5 SHEET METAL FABRICATIONS

- A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.
- B. Miscellaneous Exposed Trim, Scuppers, Fascia, Base Flashing: Fabricate from the following material:
 - 1. Aluminum: 0.040 inch (1 mm) thick

C. Counterflashing, Flashing Receivers: Fabricate from the following material:

1. Aluminum: 0.032 inch (0.813 mm) thick

2.6 ALUMINUM FINISHES

- A. General: Comply with Aluminum Association's (AA) "Designation System for Aluminum Finishes" for finish designations and application recommendations.
- B. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605 (extrusions) or AAMA 620/621 (coil coatings).
 2. Colors: As selected by Architect for each location.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.
- B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

- C. Roof-Edge Flashings and Edge Securement: Secure metal flashings, copings and edge securement at roof edges according to Building Code of NY, Chapter 16 for specified wind zone.
- D. Isolation: Where metal surfaces of units are installed in contact with dissimilar metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation as recommended by sheet metal producer.
- E. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- F. Sealed Joints: Form nonexpansion, but movable, joints in aluminum to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.
 - 1. Use joint adhesive for nonmoving joints specified not to be soldered.
- G. Seams in Aluminum: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- H. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.
 - 1. Underlayment: Where installing copper or aluminum directly on cementitious or wood substrates, install a slip sheet of red-rosin paper over one layer of felt underlayment before installing sheet metal.
 - 2. Bed flanges in a thick coat of roofing cement where required for waterproof performance.
- I. Install reglets to receive counterflashing according to the following requirements:
 - 1. Where reglets are shown in concrete, furnish reglets for installation under Division 03 Section "Cast-in-Place Concrete."
 - 2. Where reglets are shown in masonry, furnish reglets for installation under Division 04 Sections.
- J. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches (50 mm) and bed with sealant.

- K. Fascia and Copings: Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners. Anchor fasciae and copings 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

3.3 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION 07 6200

SECTION 07 7200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Roof hatches
2. Hatch safety railing system
3. Ladder safety post.

B. Related Work Specified Elsewhere:

1. Roof ladders are specified in Division 05 Section "Metal Fabrications."

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, materials, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other Work.
- C. Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:
1. Size and location of roof accessories specified in this Section.
 2. Method of attaching roof accessories to roof or building structure.
 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

1.3 QUALITY ASSURANCE

A. Standards: Comply with the following:

1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Babcock-Davis Hatchways, Inc.
2. Bilco Company.
3. Greenheck
4. Milcor, Inc.

2.2 MATERIALS, GENERAL

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M) for alclad alloy 3005H25 or alloy and temper required to suit forming operations, with mill finish, unless otherwise indicated.
- B. Extruded Aluminum: ASTM B 221 (ASTM B 221M) alloy 6063-T52 or alloy and temper required to suit structural and finish requirements, with mill finish, unless otherwise indicated..
- C. Insulation: Manufacturer's standard rigid or semirigid glass-fiber board of thickness indicated.
- D. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.
- E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
- F. Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coating.
- G. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- H. Elastomeric Sealant: Generic type recommended by unit manufacturer that is compatible with joint surfaces; ASTM C 920, Type S, Grade NS, Class 25, and Uses NT, G, A, and, as applicable to joint substrates indicated, O.
- I. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.3 ROOF HATCHES

- A. General: Fabricate units to withstand 40-lbf/sq. ft. (1.9- kPa) external and 20-lbf/sq. ft. (0.95-kPa) internal loading pressure. Frame with minimum 12-inch- (300-mm-) high, integral-curb, double-wall construction with 1-inch (25- mm) insulation, formed cants and cap flashing (roofing counterflashing), with welded or sealed mechanical corner joints. Provide double-wall cover (lid) construction with 1- inch- (25-mm-) thick insulation core.

Provide EPDM compression gasketing and equip with corrosion-resistant or hot-dip galvanized hardware including pintle hinges, lifting mechanisms, hold-open devices, interior and exterior padlock hasps, and both interior and exterior latch handles.

B. Type: Single-leaf equipment access.

1. Size: 30" x 96".
2. Material: Aluminum cover and curb.
3. Finish: Mill.
4. Basis of Design Product: Type L Roof Hatch manufactured by Bilco or equal

C. Type: Single-leaf personnel access.

1. Size: 36" x 36".
2. Material: Aluminum cover and curb.
3. Finish: Mill.
4. Basis of Design Product: Type E Roof Hatch manufactured by Bilco or equal

2.4 ROOF HATCH ACCESSORIES

A. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, self-closing gate, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.29 requirements and authorities having jurisdiction.

1. Height: 42 inches (1060 mm) above finished roof deck.
2. Posts and Rails: 1-1/4" diameter 6061 T6 Schedule 40 aluminum pipe.
3. Gate: Self-latching, self-closing.
4. Finish: Safety yellow powder coat paint.
5. Sizes: Fabricate to accommodate each type of roof hatch.
6. Basis of Design Product:
 - a. For 36" x 36" hatch, provide Bil-Guard Hatch Railing System Model RL2-E manufactured by Bilco or equal.
 - b. For 30" x 96" hatch, provide Bil-Guard Hatch Railing System Model RL2-L manufactured by Bilco or equal.

2.5 ROOF HATCH ACCESSORIES

A. Ladder Safety Post: Preassembled unit with tubular post locking automatically when fully extended, and controlled upward and downward movement, release lever to disengage the post to allow it to be returned to its lowered position, and adjustable mounting brackets to fit ladder rungs.

1. Material: Steel
2. Balancing Spring and Hardware Material: Stainless steel
3. Steel Finish: Safety yellow powder coat.
4. Basis of Design Product: Bilco Ladder-Up Safety Post, Model LU-1 or equal.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Powder Paint Finish: Manufacturer's standard.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written instructions. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight. Anchor roof accessories securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.
- B. Install roof accessory items according to construction details of NRCA's "Roofing and Waterproofing Manual," unless otherwise indicated.
- C. Separation: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.
- D. Flange Seals: Unless otherwise indicated, set flanges of accessory units in a thick bed of roofing cement to form a seal.
- E. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counterflashing). Seal overlap with thick bead of mastic sealant.
- F. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

3.2 CLEANING AND PROTECTION

- A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION 07 7200

SECTION 07 8100 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes sprayed fire-resistive materials (SFRM).
- B. Locations of sprayed fire-resistive materials includes the following:
 - 1. Steel columns, tube and wide-flange, where indicated
 - 2. Steel beams, where indicated.
 - 3. Any other area indicated on the Drawings.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site
 - 1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. UL Designs: For each UL Design proposed for use.
- D. Shop Drawings: Framing plans, schedules, or both, indicating the following:
 - 1. Extent of fireproofing for each construction and fire-resistance rating.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
 - 4. Treatment of fireproofing after application.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Product Certificates: For each type of fireproofing.
- C. Evaluation Reports: For fireproofing, from ICC-ES.
- D. Preconstruction Test Reports: For fireproofing.
- E. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for materials and execution and for preconstruction testing.
 - 1. Build mockup of each type of fireproofing and different substrate as shown on Drawings.
 - 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.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups of fireproofing.
 - 1. Provide test specimens and assemblies representative of proposed materials and construction.
- B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
 - 1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 - 2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 - 3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
 - 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F (7 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fireproofing from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. Fireproofing and primers shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".
- E. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

- A. SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.
 - 1. Basis of Design Product: Provide Isolatek International; Cafco Blaze-Shield II or equal.
 - 2. Bond Strength: Minimum 150-lbf/sq. ft. (7.18-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
 - 3. Density: Not less than 15 lb/cu. ft. (240 kg/cu. m) and as specified in the approved fire-resistance design, according to ASTM E 605.
 - 4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
 - 5. Combustion Characteristics: ASTM E 136.
 - 6. 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: 10 or less.
 - b. Smoke-Developed Index: 10 or less.
 - 7. Compressive Strength: Minimum 1,440 lbf/sq. in. (68.9 kPa) according to ASTM E 761.
 - 8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
 - 9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
 - 10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.

11. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E 859.
12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G21.
13. Sound Absorption: NRC of 0.75 according to ASTM C423 for Type A mounting according to ASTM E795.
14. Finish: Spray-textured finish.
15. UL Designs:
 - a. As required to achieve 2-hour fire-rating at columns.
 - b. As required to achieve 2-hour fire-rating at beams.
16. Adjust thickness of sprayed on material for columns and beams (lintels) with W/D ratio less than the W/D ratio of the specified assembly, as described in UL Fire Resistance Directory, Design Information Section at the front of the directory.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
 1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.
- C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.
- E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

- F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:
 - 1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
 - 2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - 3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
- B. Verify that concrete work on steel deck has been completed before beginning fireproofing work.
- C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work is complete before beginning fireproofing work.
- D. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of

fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

- E. For areas with spray material on beams only, and exposed steel deck, cover deck to limit overspray of materials. Remove protective covering upon completion

3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
 - 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Metal Decks:
 - 1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.
 - 2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.
- E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- F. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- G. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

- J. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.
- K. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- L. Cure fireproofing according to fireproofing manufacturer's written recommendations.
- M. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- N. Finishes: Where indicated, apply fireproofing to produce the following finishes:
 - 1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
- O. The substrate shall have a minimum ambient temperature before and after application as specified in the approved manufacturer's written instructions. The area for application shall be ventilated during and after application as required by the approved manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections as required by the BCNYS, Subsection 1705.13, "Sprayed Fire-Resistant Materials."
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Fireproofing will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
 - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07 8100

SECTION 07 8413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in fire-resistance-rate horizontal assemblies.
3. Penetrations in non-fire-resistance-rate horizontal assemblies.
4. Penetrations in smoke barriers, smoke partitions and smoke tight partitions.

B. Related Sections:

1. Section 078446 "Fire-Resistive Joint Systems" 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 indicated.

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.4 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.

- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
 - b. Classification markings on penetration firestopping correspond to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
 - 3) FM Global in its "Building Materials Approval Guide."
- C. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Penetration Firestop Systems specified in the Schedule in Part - 3 include:
 - a. Fire Barrier Products, 3M Fire Protection Products
 - b. RectorSeal Corporation.
 2. Subject to compliance with specified requirements, provide Penetration Firestop Systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory (BXRH), by one of the following:
 - a. Hilti, Inc.
 - b. Nelson Firestop Products.
 - c. RectorSeal Corporation.
 - d. Specified Technologies Inc.
 - e. 3M Fire Protection Products.
 - f. Wiremold/Legrand

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of 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: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls, and fire partitions.
 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. Horizontal assemblies include floors and floor/ceiling assemblies.
 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

- E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
- F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- G. VOC Content: Penetration firestopping sealants and sealant primers shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements"..
- H. 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 manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. 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 indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 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.

3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. 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 - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.

6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. For penetrations in non-fire rated horizontal assemblies, smoke barriers, smoke partitions and smoke tight partitions, provide systems tested for 1 hour unless otherwise noted.
- C. Basis of Design Assemblies: Subject to compliance with requirements, provide the design indicated below or a comparable UL design by one of manufacturer's listed in Part 2 above.
 - 1. Schedule of construction components, type of penetrant, and U.L. Penetration Firestop Systems include, but are not limited to the following:
 - 2. Schedule of construction components, type of penetrant, and U.L. Penetration Firestop Systems include, but are not limited to the following:

	P E N E T R A N T						
	Metal Conduit	Cable Tray ⁴	Cables	Non-Insul. Metal Pipe	Insul. Pipe	FR Polypropylene Pipe	Insul. Metal Duct

	P E N E T R A N T						
	Metal Conduit	Cable Tray⁴	Cables	Non-Insul. Metal Pipe	Insul. Pipe	FR Polypropylene Pipe	Insul. Metal Duct
GWB Stud Wall, or Shaft Wall up to 2 Hr Rating	W-L-1001	W-L-4004	W-L-3001	W-L-1001	W-L-5011	W-L-2002	W-L-7006 ³
CMU Wall up to 2 Hr Rating	C-AJ-1044	C-AJ-4003	C-AJ-3030	C-AJ-1044	C-AJ-5001	C-AJ-2001	C-AJ-7003 ³ , 7016 ³
Concrete Floor / Metal Deck 1 Hr Rated F and T-Rating²	C-AJ-1008	N/A	C-AJ-3029	C-AJ-1008	C-AJ-5002	F-A-2002	C-AJ-7009 ⁵
Concrete Floor / Metal Deck 2 Hr Rated F and T-Rating²	C-AJ-1008	N/A	C-AJ-3029	C-AJ-1008	C-AJ-5060	F-A-2002	N/A
Concrete Floor / Metal Deck up to 2 Hr F Rated¹	F-A-1002	N/A	C-AJ-3030	C-AJ-1044	C-AJ-5001	F-A-2002	N/A

KEY TO NOTES

1. Penetration within wall cavity.
2. Penetration that does not fall within wall cavity, T-Rating required.
3. Up to 1 hour rating, submit engineered judgement firestopping system for this combination of penetrant, wall/floor assembly, and fire rating. Install fire dampers in 2-hour walls in accordance with manufacturer's instructions and testing agency requirements.
4. Where cable tray extends through wall.
5. For floor penetrations not enclosed above and below the floor with shaft wall.

D. Membrane Penetrations:

1. Firestop membrane penetrations by cables, pipes and conduit similar to through wall penetrations.
 2. Provide putty pad box wrap firestopping for membrane penetrations in rated walls for electrical back boxes over 16 sq. inches, where any back boxes are located within 24 inches horizontal of another back box, or when total area of back boxes exceeds 100 sq in. in 100 sq. ft. of wall area.
- E. Where another type of construction or penetrant is encountered, or if field conditions vary from those described in the U.L. System listed (i.e. annular space is greater/smaller, insulation type varies, etc.), provide firestopping systems which are appropriate, and U.L. tested, for that condition.

END OF SECTION 07 8413

SECTION 07 8446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

B. Related Sections:

1. Section 07 8413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
2. Section 07 9500 "Expansion Control" for fire-resistive architectural joint systems.

1.2 ACTION SUBMITTALS

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

B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems 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 fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

- B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
 - 1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
 - a. Fire-resistive joint system products bear classification marking of qualified testing agency.
 - b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
- C. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint 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 fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
 3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Grace Construction Products.
 - b. Hilti, Inc.
 - c. RectorSeal Corporation.
 - d. Specified Technologies Inc.
 - e. 3M Fire Protection Products.
 - f. Tremco, Inc.; Tremco Fire Protection Systems Group.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa) or ASTM E 2307.
1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Grace Construction Products.
 - b. Hilti, Inc.
 - c. Johns Manville.
 - d. RectorSeal Corporation.
 - e. Specified Technologies Inc.
 - f. 3M Fire Protection Products.
 - g. Tremco, Inc.; Tremco Fire Protection Systems Group.
- D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
1. L-Rating: Not exceeding 5.0 cfm/ft (0.00775 cu. m/s x m) of joint at 0.30 inch wg (74.7 Pa) at both ambient and elevated temperatures.
 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Grace Construction Products.
 - b. Hilti, Inc.
 - c. Johns Manville.
 - d. RectorSeal Corporation.
 - e. Specified Technologies Inc.

- f. 3M Fire Protection Products.
 - g. Tremco, Inc.; Tremco Fire Protection Systems Group.
- E. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Fire-resistive joint system sealants shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".
- G. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support 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 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.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels will be visible to anyone seeking to remove or penetrate joint 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 - Fire-Resistive Joint System - 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.

3.5 FIELD QUALITY CONTROL

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

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 FIRE-RESISTIVE JOINT SYSTEM / FIRESTOP JOINT SYSTEM SCHEDULE

- A. Where UL-classified firestop joint systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHBN.

Firestop Joint System Location	Basis-of-Design	Assembly Rating	Nominal Joint Width	Movement Capabilities ²
Floor-to-Wall				
Rated concrete masonry wall construction intersection with adjacent floor construction	FW-D-1012, FW-D-1013	1 hour or 2 hours ¹	As indicated, or required by tested assembly	Class II
Head-of-Wall				
Rated gypsum wall construction intersection with steel floor deck above	HW-D-0087, or HW-D-0089	1 hour or 2 hours ¹	As indicated, or required by tested assembly	Class II or III,
Rated gypsum wall construction intersection with concrete floor deck above	HW-D-0083, HW-D-209	1 hour or 2 hours ¹	As indicated, or required by tested assembly	Class II
Rated concrete masonry wall construction intersection with steel floor deck above	HW-D-0081, or HW-D-0098	1 hour or 2 hours ¹	As indicated, or required by tested assembly	Class II
Rated concrete masonry wall construction intersection with concrete floor deck above	HW-D-0268, HW-D-0097	1 hour or 2 hours ¹	As indicated, or required by tested assembly	Class II
Bottom-of-Wall				

Rated gypsum wall construction intersection with concrete floor	BW-S-0002	1 hour or 2 hours ¹	As indicated, or required by tested assembly	Static
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1. Rating to match wall construction.
2. Class UL2079

- B. Where another type of construction is encountered, or if field conditions vary from those described in the U.L. System listed (i.e. annular space is greater/smaller, insulation type varies, etc.), provide firestopping systems which are appropriate, and U.L. tested, for that condition.

3.8 PERIMETER FIRE-CONTAINMENT-FIRESTOP SYSTEMS

- A. Where perimeter Fire-Containment-Firestop systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHDG.

Perimeter Fire-Containment, Firestop System Location	Basis-of-Design	Integrity Rating	Insulation Rating	Linear opening Width
Aluminum Curtainwall	CW-D-2046	[1 hour] [2 hours]	[1/4] hour	8 inches (203 mm), maximum
Gypsum Sheathed Curtainwall	CW-S-1001	[1-1/2 hour]	[3/4] [1] hour	8 inches (203 mm), maximum

END OF SECTION 07 8446

ATTACHMENT: FIRESTOP JOINT SYSTEMS SUBMITTAL SHEET

3.9 FIRESTOP JOINT SYSTEMS SUBMITTAL SHEET

- A. **HEAD-OF-WALL FIRESTOPPING:** Fill in the U.L. Design number and attach copy of U.L. Test. Insert n/a if condition is not applicable.

1. Gypsum wall construction intersection with floor deck above: _____.
Gypsum wall construction intersection with roof deck above: _____.
2. Concrete masonry wall construction intersection with floor deck above: _____.
3. Concrete masonry wall construction intersection with roof deck above: _____.

- B. **FLOOR-TO-WALL FIRESTOPPING:** Fill in the U.L. Design number and attach copy of U.L. Test. Insert n/a if condition is not applicable.

1. Concrete masonry wall construction intersection with adjacent floor construction: _____.

- C. **BOTTOM-OF-WALL FIRESTOPPING:** Fill in the U.L. Design number and attach copy of U.L. Test. Insert n/a if condition is not applicable.

1. Gypsum wall construction intersection with floor deck: _____. Gypsum wall construction intersection with roof deck above: _____.
2. Concrete masonry wall construction intersection with floor _____.
3. Concrete masonry wall construction intersection with roof deck above: _____.

- D. **CURTAIN WALL FIRESTOPPING:** Fill in the design number and copy test. Insert n/a if condition is not applicable.

1. Aluminum mullion and glass spandrel panel curtainwall intersection with adjacent floor construction: _____.
2. Gypsum sheathed curtainwall intersection with adjacent floor construction: _____.

- E. **OTHER:** Where another type of construction or penetrant is encountered, attach a separate sheet listing each condition and attach copy of the U.L. Test.

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes joint sealants for the following locations:
1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
 - a. Control and expansion joints in cast-in-place concrete
 - b. Joints in brick veneer wall surfaces.
 - c. Joints in metal wall panel systems.
 - d. Joints at cast stone units.
 - e. Joints at solid composite wall panels.
 - f. Joints between different materials listed above
 - g. Perimeter joints between materials listed above and frames of aluminum entrance and storefront framing, aluminum curtainwall framing, and frames of doors, louvers and windows.
 - h. Control and expansion joints in ceiling and overhead surfaces.
 - i. Other joints as indicated.
 2. Exterior joints in the following horizontal traffic surfaces:
 - a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.
 3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - d. Perimeter joints between interior wall surfaces and frames of interior doors, windows, storefront and entrance framing, curtain wall framing, and elevator entrances.
 - e. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - f. Tile control and expansion joints
 - g. Openings and joints in sound-rated partitions.
 - h. Other joints as indicated.
 4. Interior joints in the following horizontal traffic surfaces:
 - a. Control and expansion joints in tile flooring.
 - b. Control and expansion joints in cast-in-place concrete slabs.
 - c. Other joints as indicated.

B. Related Sections include the following:

1. Sealants used in glazing are specified in Division 08 "Glazing."
2. Sealants used as part of proprietary acoustical wall assemblies are specified in Division 09 Section "Gypsum Board."
3. Coordinate work of this section with all sections referencing it.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.
- C. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2-inch (13-mm)) wide joints formed between two 6-inch (150-mm) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

1.4 INFORMATIONAL SUBMITTALS

- A. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.
- B. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project names addresses, names of Architects and Owners, plus other information specified.
- C. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.
- D. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

- E. Preconstruction field test reports indicating which products and joint preparation methods demonstrate acceptable adhesion to joint substrates.
- F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an installer who has successfully completed at least three (3) joint sealer applications similar in type and size to that of this project within the last five (5) years. All workers used for work of this Section shall be experienced in the techniques of sealant application and shall be completely familiar with the published recommendations of the manufacturer of the joint sealant materials being used.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:
 - 1. Locate test joints where indicated or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of non-elastomeric sealant and joint substrate indicated.
 - 3. Notify Architect one week in advance of the dates and times when mock-ups will be erected.
 - 4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
 - 5. Test Method: Test joint sealants by hand pull method described below:
 - a. Install joint sealants in 60 inches (1500 mm)) joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allow sealants to cure fully before testing.
 - b. Make knife cuts horizontally from one side of joint to the other followed by 2 vertical cuts approximately 2 inches (50 mm) long at side of joint and meeting horizontal cut at top of 2-inch (50-mm) cuts. Place a mark 1 inch (25 mm) from top of 2-inch (50-mm) piece.
 - c. Use fingers to grasp 2-inch (50-mm) piece of sealant just above 1-inch (25-mm) mark; pull firmly down at a 90-degree angle or more while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
 - 6. Report whether or not sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
 - 7. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be

considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

- D. Field-Constructed Mock-Ups: Prior to installation of joint sealants, apply elastomeric sealants as follows to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution:
 - 1. Joints in field-constructed mock-ups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants specified in this Section.
- E. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of the Division 01 Section covering this activity.
- F. Random Field Tests: Periodically test sealants, in place, for adhesion, using methods recommended by sealant manufacturer. Promptly replace any sealant that does not adhere, fails to cure, or fails to perform as specified by the sealant manufacturer.
- G. Field Water Test: Perform two field water tests on completed areas including as many conditions as possible. If leakage occurs during testing, repair as required, and re-test area and also test two additional locations.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F (4 deg C).
 - 2. When joint substrates are wet.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 COORDINATION

- A. Coordinate the work with all sections referencing this section.

1.9 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

- 1. Warranty Period: Two years from date of Substantial Completion.

- B. Manufacturer's Warranty: Provide written warranty agreeing to repair or replace, at no cost to Owner, defective materials for twenty (20) years, and workmanship for two (2) years from the Date of Substantial Completion. Defective materials and workmanship shall include, but are not limited to:

- 1. Deterioration, aging or weathering of the work;
 - 2. Water leakage and/or air leakage;
 - 3. Sealant loss of adhesion, loss of cohesion, cracking or discoloration;
 - 4. Staining or discoloration of adjacent surfaces;
 - 5. Joint failure due to building or joint movement up to the limits prescribed by the manufacturer;
 - 6. Cracks or bubbles on sealant surface.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealants to comply with the following:
 - 1. Provide selections made by Architect from manufacturer's standards or custom colors to match Architect's samples, as directed by Architect.
- C. Additional Movement Capability: Where additional movement capability is specified, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTM C 920 for Uses indicated.
- D. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with Section 018113 "Sustainable Design Requirements".

- E. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project

2.2 LATEX JOINT SEALANT

- A. Acrylic-Emulsion Sealant: Manufacturer's standard, one part, nonsag, mildew-resistant, paintable latex acrylic-emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent.
 - 1. Available Products: Subject to compliance with requirements, latex joint sealants that may be incorporated in the Work include, but are not limited to, the following:
 - a. AC-20; Pecora Corporation.
 - b. Tremflex 834; Tremco.
 - c. ALEX PLUS; DAP .
- B. Uses: General interior use, paintable.

2.3 MILDEW-RESISTANT SILICONE JOINT SEALANT

- A. Single-Component Mildew-Resistant Silicone Sealant: Manufacturer's standard, non-modified, one-part, silicone sealant; complying with ASTM C 920, Type S, Grade NS, Class 25, Uses NT, G, A, and, as applicable to non-porous joint substrates indicated, O. Formulate sealant with fungicide and specifically intended for sealing interior joints with nonporous substrates and subject to in-service exposure to conditions of high humidity and temperature extremes.
 - 1. Available Products: Subject to compliance with requirements, silicone joint sealants that may be incorporated in the Work include, but are not limited to, the following:
 - a. 786 Mildew Resistant; Dow Corning.
 - b. Sanitary 1700; GE Silicones.
 - c. 898 Silicone Sanitary Sealant; Pecora Corporation.
 - d. Tremsil 600 White; Tremco.
- B. Uses: Interior use in wet locations, and all toilet and shower rooms.

2.4 NONSAG URETHANE JOINT SEALANT

- A. Multicomponent Nonsag Urethane Sealant: Manufacturer's standard, non-modified, multi-part, nonsag urethane sealant; complying with ASTM C 920, Type M, Grade NS, Class 25, Uses NT, M, G, A, and as applicable to joint substrates indicated, O.
 - 1. Available Products: Subject to compliance with requirements, urethane joint sealants that may be incorporated in the Work include, but are not limited to, the following:

- a. Dynatrol II, Pecora Corporation
- b. Sikaflex-2c NS, Sika Corporation
- c. Dymeric 240FC; Tremco.
- d. Masterseal NP 2; Master Builders Solutions Div., BASF

- B. Uses: Interior use for exposed concrete or masonry wall control joints

2.5 SILICONE JOINT SEALANT

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100, for Use G, A, M, O; non-staining and field-tintable.
 - 1. Basis of Design Product: Provide Pecora Corporation "890FTS" sealant or equal manufactured by one of the following:
 - a. Dow Corning Corporation.
 - b. GE Advanced Materials - Silicones
 - c. Sika Corporation, Construction Products Division
 - d. Tremco Incorporated
- B. Additional Movement Capability: 100 percent movement in extension and 50 percent in compression for a total of 150 percent movement.
- C. Uses: General exterior use.

2.6 POURABLE URETHANE JOINT SEALANT

- A. Multicomponent Pourable Urethane Sealant: Manufacturer's standard, non-modified, two-part, urethane sealant; complying with ASTM C 920, Type M, Grade P, Class 25, Uses T, M, A and, as applicable to joint substrates indicated, O.
 - 1. Available Products: Subject to compliance with requirements, urethane joint sealants that may be incorporated in the Work include, but are not limited to, the following:
 - a. NR-200 Urexpan, Pecora Corporation
 - b. Sikaflex 2c SL, Sika Corporation
 - c. Masterseal SL 2; Master Builders Solutions Div., BASF
- B. Uses: Interior or exterior use for level pavement or slab joints.

2.7 NONSAG URETHANE JOINT SEALANT

- A. Multi-Part Non-Sag Urethane Sealant: Except as otherwise indicated, provide manufacturer's standard, non-modified, two-part, urethane sealant; complying with ASTM C 920, Type M, Grade NS, Class 25, Uses T, M, A and, as applicable to joint substrates indicated, O.

1. Available Products: Subject to compliance with requirements, urethane joint sealants that may be incorporated in the Work include, but are not limited to, the following:
 - a. Sikaflex 2c NS; Sika Corp
 - b. Dynatred, Pecora Corporation
 - c. Masterseal NP 2; Master Builders Solutions Div., BASF
- B. Uses: Interior or exterior use for pavement or slab joints where slope exceeds one percent.

2.8 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant: Non-sag (gun grade), non-flammable, latex-based sealant designed to limit sound transmission through interior STC-rated partitions. Sealant remains flexible and adhered to metal, wood, plaster, gypsum, and concrete after drying.
 1. Maintains the STC rating of partitions with intersections and penetrations sealed with product: Tested by independent, accredited, NVLAP facility according to ASTM E 90.
 2. Products: Provide one of the following:
 - a. QuietZone Acoustic Sealant by Owens Corning.
 - b. OSI GreenSeries SC-175 Draft & Acoustical Sound Sealant by Henkel Corporation
 - c. Pecora AIS-919: Acoustical and Insulation Latex Sealant by Pecora Corporation
 - d. Smoke 'N' Sound Acoustical Sealant by Specified Technologies Inc.
- B. Uses: At penetrations through and intersections of sound-rated wall, floor and ceiling assemblies in order to preserve their ability to reduce airborne sound impact noise transmission.

2.9 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
 2. Manufacturer: Provide Cera-Rod manufactured by W.R. Meadows, Inc., or equivalent.

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.10 JOINT FILLERS FOR EXTERIOR CONCRETE SLABS

- A. General: Provide joint fillers of thickness and depth indicated, or if not indicated 1/2" thick by depth of joint.
- B. Bituminous Fiber Joint Filler: Provide preformed strips of with asphalt binder encased between two layers of saturated felt or glass-fiber felt, complying with ASTM D 1751.
 - 1. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint and seal with sealant.

2.11 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 3. Remove laitance and form release agents from concrete.
 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
- D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 - a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 9200

SECTION 07 9500 - EXPANSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Types of joints for which architectural joint systems are specified include the following:
 - 1. Interior wall and ceiling joints.
 - 2. Exterior roof expansion joint.
 - 3. Exterior wall expansion joint
- B. Related Sections include the following:
 - 1. Division 07 Section "Joint Sealants" for elastomeric sealants and preformed compressed-foam sealants without metal frames.

1.2 DEFINITIONS

- A. Architectural Joint System: Any filler or cover used to span, fill, cover, or seal a joint, except expanding foam seals and poured or foamed in-place sealants.
- B. Cyclic Movement: Periodic change between widest and narrowest joint widths in an automatically mechanically controlled system.
- C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist passage of flame and hot gases through a movement joint.
- D. Maximum Joint Width: Widest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.
- E. Minimum Joint Width: Narrowest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.
- F. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage of nominal value of joint width.
- G. Nominal Joint Width: Width of linear gap indicated as representing the conditions existing when architectural joint systems will be installed or, if no nominal joint width is indicated, a width equal to the sum of maximum and minimum joint widths divided by two.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide factory-fabricated architectural joint systems capable of withstanding the types of loads and of accommodating the kinds of movement, and the other functions

for which they are designed including those specified below, without failure. Types of failure include those listed in Appendix X3 of ASTM E 1399.

1. Pedestrian Traffic Joints: Support pedestrian traffic across joint.
2. Exterior Joints: Maintain continuity of weather enclosure.
3. Joints in Fire-Resistance-Rated Assemblies: Maintain fire-resistance ratings of assemblies.
4. Joints in Smoke Barriers: Maintain integrity of smoke barrier.
5. Other Joints: Where indicated, provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.
6. Joints in Surfaces with Architectural Finishes: Serve as finished architectural joint closures.

1.4 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's product specifications, construction details, material and finish descriptions, and dimensions of individual components and seals.
- B. Shop Drawings: For each joint system specified, provide the following:
 1. Placement Drawings: Include line diagrams showing entire route of each joint system, plans, elevations, sections, details, joints, splices, locations of joints and splices, and attachments to other Work. Where joint systems change planes, provide Isometric Drawings depicting how components interconnect to achieve continuity of joint covers and fillers.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each exposed metal and elastomeric material of joint system indicated.
 1. Include similar Samples of material for joints and accessories involving color selection.
- D. Samples for Verification: Full-size units 6 inches (150 mm) long of each type of joint system indicated; in sets for each finish, color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: From a qualified testing agency indicating architectural joint systems comply with requirements, based on comprehensive testing of current products.
- B. Research/Evaluation Reports: Evidence of architectural joint system's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain architectural joint systems through one source from a single manufacturer. Coordinate compatibility with adjoining joint systems specified in other Sections.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of architectural joint systems and are based on the specific systems indicated. Other manufacturers' systems complying with requirements may be considered. Refer to Division 01 Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Products: The design for each architectural joint system specified in Part 2 "Architectural Joint Systems" Article below is based on the products named. Subject to compliance with requirements, provide either the named products or comparable products by one of the following:
 - 1. M M Systems
 - 2. Balco, Inc.
 - 3. Construction Specialties, Inc.
 - 4. Inpro
 - 5. Watson Bowman Acme.

2.2 MATERIALS

- A. Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), alloy 6061-T6 for sheet and plate.
 - 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Preformed Seals: Single or multicellular extruded elastomeric seals designed with or without continuous, longitudinal, internal baffles. Formed to be installed in frames or with anchored flanges, in color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.
- C. Strip Seals: Elastomeric membrane or tubular extrusions with a continuous longitudinal internal baffle system throughout complying with ASTM E 1783; used with compatible frames, flanges, and molded-rubber anchor blocks.

- D. Compression Seals: Preformed, elastomeric extrusions having internal baffle system complying with ASTM E 1612 in sizes and profiles indicated or as recommended by manufacturer.
- E. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesives, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.3 ARCHITECTURAL JOINT SYSTEMS

- A. General: Provide joint systems of design, basic profile, materials, and operation indicated. Provide units with the capability to accommodate joint widths indicated and variations in adjacent surfaces.
 - 1. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials.
 - 2. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.
 - 3. Frames for Strip Seals: Designed with semiclosed cavity that provides a mechanical lock for seals of type indicated.
- B. Interior Wall-to-Wall Architectural Joint System (Type BMJ-W1): Aluminum exterior cover and interior frame along with a galvanized steel slide and base frame for interior wall joints.
 - 1. Basis-of-Design Product: MM Model VSL-1-.5, or equal.
 - 2. Nominal Joint Width: 1 inches.
 - 3. Exposed Cover Finish: Clear anodized.
 - 4. Provide fire barrier where required, of same rating as wall.
- C. Interior Ceiling-to-Ceiling Architectural Joint System (Type BMJ-C1): Metal frames and elastomeric seal for interior, suspended ceilings.
 - 1. Basis-of-Design Product: MM Model VSG-200, or equal.
 - 2. Nominal Joint Width: 2 inch.
 - 3. Color of Elastomeric Seal: As selected by Architect.
 - 4. Frame Material: Aluminum extrusions, mill finish
- D. Exterior Roof Expansion Joint / Waterproofing Joint System (Type BMJ-R1): Elastomeric (EPDM) bellows type seal with stainless steel flanges for roof locations.
 - 1. Basis-of-Design Product: MM Model ERJ-200, or equal.
 - 2. Nominal Joint Width: 2 inches.
 - 3. Color of Exposed Elastomeric Material: Black.
 - 4. Provide secondary moisture barrier.

- E. Exterior Expansion Joint / Waterproofing Joint System: Manufacturer's standard preformed, precompressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water repellent agent; factory-produced in precompressed sizes and in roll or stick form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer. Seal shall combine factory-applied, low-modulus silicone surface and a backing of acrylic-impregnated expanding foam into a unified hybrid sealant system, and comply with the following requirements:
1. Properties: Permanently elastic, mildew-resistant, nonmigratory, nonstaining, and compatible with substrates indicated.
 2. Density: Manufacturer's standard.
 3. Movement Capability: 100% expansion and contraction
 4. Thickness As indicated on Drawings for each location
 5. Color of Exposed Material: As selected by Architect to match adjacent wall color.
 6. Basis of Design Product: Provide Seismic Colorseal by Emseal Joint Systems, LTD, a SIKA company, or equal products manufactured by one of the following:
 - a. MM Systems Corporation.
 - b. Sandell Manufacturing Co., Inc.
 - c. Watson Bowman Acme Corporation.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to architectural joint system manufacturer's written instructions.
- B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for handling and installing architectural joint assemblies and materials, unless more stringent requirements are indicated.
- B. Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.
- C. Terminate exposed ends of exterior architectural joint assemblies with factory-fabricated termination devices to maintain waterproof system.

- D. Install factory-fabricated transitions between building expansion-joint cover assemblies and roof expansion-joint assemblies to provide continuous, uninterrupted, watertight construction.
- E. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install joint systems.
 - 1. Install joint cover assemblies in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 2. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.
 - 3. Set covers in horizontal surfaces at elevations that place exposed surfaces flush with adjoining finishes.
 - 4. Locate wall, ceiling, and soffit covers in continuous contact with adjacent surfaces.
 - 5. Securely attach in place with required accessories.
 - 6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.
- F. Continuity: Maintain continuity of joint systems with a minimum number of end joints and align metal members. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials, if any, to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- G. Joint Systems with Seals: Seal end joints within continuous runs and joints at transitions according to manufacturer's written instructions to provide a watertight installation.
- H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

3.3 CLEANING AND PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

END OF SECTION 07 9500

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following hollow-metal work:

1. Steel doors
2. Steel door frames
3. Borrowed-light and sidelight frames.
4. Fire-rated door and frame assemblies.

B. Related Requirements:

1. Section 08 7100 "Door Hardware" for door hardware for hollow-metal doors.
2. Section 08 8023 "Interior Glazing" and for glazing inserted in hollow metal doors and frames..

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to 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 that are to be embedded in adjacent construction. Deliver such items to Project site in time for installation.
- B. Coordinate preparation of shop drawings for hollow metal doors and frames with door hardware submittals specified in Section 08 7100. Shop drawings for work of this section will not be reviewed and approved until the hardware submittals in Section 08 7100 are submitted and approved.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
1. Elevations of each door type.

2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.

- B. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

- C. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

- D. Field quality control reports.

1.7 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80, Section 5.2.3.1.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ceco Door Products; an Assa Abloy Group company.
 - 2. Curries Company; an Assa Abloy Group company.
 - 3. Republic Doors and Frames.
- 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 indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.
- C. Exterior Door and Frame Performance Criteria for Air Infiltration: Maximum 0.2 CFM/SQ FT when tested in accordance with NFRC 400.
- D. Thermally Rated Door Assemblies: Provide exterior door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. (2.27 W/K x sq. m) when tested according to ASTM C518.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. Provide for interior door and frame locations.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).

- c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 16 gage 0.053 inch (1.3 mm), except as noted below.
 - 1) Metallic-coated, with minimum A40 (ZF120) coating at the following locations: As scheduled
 - d. Edge Construction: Model 1, Full Flush
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - f. Basis of Design Product: Regent Door by Ceko Doors, or equal.
3. Frames:
- a. Materials: Minimum thickness of 16 gage, 0.053 inch (1.3 mm), uncoated, steel sheet for the following locations:
 - 1) Wood doors, unless otherwise indicated.
 - b. Materials: Minimum thickness of 14 gage, 0.067 inch (1.7 mm), uncoated, steel sheet (except provide metallic coated where door is metallic coated) for the following locations:
 - 1) Level 3 steel doors
 - 2) Wood doors at all leafs wider than 36-inches (914-mm), and all electrical rooms, storage rooms, machine rooms, mechanical rooms, and maintenance areas
 - c. Construction: Full profile welded.
4. Exposed Finish: Prime door and frames

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Maximum-Duty Doors and Frames: SDI A250.8, Level 4.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Faces: Metallic-coated steel sheet, minimum thickness of 14 gage, 0.067 inch, with minimum A60 coating.
 - d. Edge Construction: Model 2, Seamless (continuously welded seams, edge filled, dressed smooth).
 - e. Core: Manufacturer's standard polystyrene, polyurethane, or polyisocyanurate core at manufacturer's discretion, to meet performance criteria specified.
 - f. Basis of Design Product: Trio-E Energy Efficient Door by Ceko Doors or equal.

3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 14 gage, 0.067 inch, with minimum A60 coating.
 - b. Construction: Full profile welded.
 - c. Basis of Design Product (Non-Rated): Mercury 3 Thermal Break Frame by Ceco Doors or equal. Provide for non-fire-rated doors only.
 - d. Basis of Design Product (Fire Rated): Model SQW, SRW Frame by Ceco Doors or equal. Provide for fire-rated doors only.
4. Exposed Finish: Prime door and frames

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- H. 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.
- I. Glazing: Comply with requirements in Sections 088023 "Interior Glazing".
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Fire Door Cores: As required to provide fire-protection ratings indicated.
 - 3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
 - 4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 - 5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 - 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 7. 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 (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
 6. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions.
 7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow-metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 6. Where Pyrostop glazing is scheduled to be inserted into openings in hollow metal doors provide door manufacturer's special window kit to accommodate thickness of glazing unit; Type 8 window kit by Curries, or equal.

2.8 STEEL FINISHES

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

2.9 ACCESSORIES

- A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation..
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.

- f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 - 6. 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.
 - 7. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
 - c. At Bottom of Door: 3/4 inch (19.1 mm) plus or minus 1/32 inch (0.8 mm).
 - d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.4 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and commissioning activities and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated door according to NFPA 80, Section 5.2.
- C. Commissioning: Commissioning of all doors shall be performed by the installer supervised by an Architectural Hardware Consultant who is thoroughly knowledgeable of the various components and systems. Include the following:
 - 1. Testing of opening force, closing device, complete closure of the door within clearance tolerances, and full engagement of latch(es) where required by door type.
 - 2. Verify cleanliness of labels, fusible links and other components that cannot be painted.
 - 3. Functional testing of automatic-closing or power-operated fire door assemblies and electrically controlled latching hardware or release devices shall be coordinated with all components of the electrically controlled system.
 - 4. After all doors have been commissioned and prior their acceptance, the Architect, in consultation with the Owner, will select doors (at least one for each operational type) whose full range operation shall be demonstrated by the Contractor to the satisfaction of the Architect.
- D. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- E. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- F. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.
- G. Prepare and submit commissioning report of all doors.

3.5 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 08 1113

SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces for transparent finish.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Division 08 Section "Hollow Metal Doors and Frames" for steel door frames.
2. Division 08 Section "Glazing" for glass view panels in flush wood doors

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.
7. Fire-protection ratings for fire-rated doors.
8. Provide schedule of doors based on door schedule included in contract documents

- C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required

3. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
 - a. Provide Samples for each species of veneer and solid lumber required.
 - b. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.

1.4 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

- B. Sample Warranty: For special warranty.

- C. Quality Standard Compliance Certificates: Provide certification on company letterhead verifying that doors have been manufactured to the AWI Quality level specified.

- D. Field quality control reports

1.5 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80, Section 5.2.3.1

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.

- B. Package doors individually in plastic bags or cardboard cartons.

- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 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 between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during remainder of construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
- b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) 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.
- B. Contractor's Responsibilities: Replace doors where Contractor's work contributed to rejection or to voiding of manufacturer's warranty

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Marshfield – Algoma by Masonite Architectural
 2. Oshkosh Door Company.
 3. VT Industries, Inc. (formerly Eggers)
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
 2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C. After 5 minutes into the NFPA 252 test, the neutral pressure level in the furnace shall be established at 40 inches (1016 mm) or less above the sill. Provide "Category A" Positive Pressure Tested doors for all fire-rated wood doors.
1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile; UL category A. Comply with specified requirements for exposed edges.
 4. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- E. Particleboard-Core Doors:
1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde.
 2. Blocking: Provide wood blocking in particleboard-core doors as follows:
 - a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
 - b. 5-inch (125-mm) bottom-rail blocking, in doors and doors indicated to have kick, mop, or armor plates.
 - c. 4-1/2-by-10-inch (114-by-250-mm) lock blocks and 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
- F. Structural-Composite-Lumber-Core Doors:
1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf (3100 N).
 - b. Screw Withdrawal, Edge: 400 lbf (1780 N).
- G. Mineral-Core Doors:
1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware, and as follows:
 - a. 5-inch (125-mm) top-rail blocking.
 - b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
 - d. 4-1/2-by-10-inch (114-by-250-mm) lock blocks and 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a. Screw-Holding Capability: 550 lbf (2440 N) per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: American Black Walnut
3. Cut: As selected by Architect.
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Exposed Vertical Edges: Same species as faces - edge Type A
7. Core:
 - a. Non-Rated Doors: Particleboard except provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors with full light or 2 lights
 - b. Fire-Rated Doors: Mineral core.
8. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
9. WDMA I.S.1-A Performance Grade: Extra Heavy Duty

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Align and fit doors in frames with uniform clearances and bevels as indicated below. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 5/8 inch (16 mm) from bottom of door to top of threshold unless otherwise indicated.

- a. Comply with NFPA 80 for fire-rated doors.
 - b. Provide specific undercut on doors as scheduled.
2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
- D. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining. 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 Division 08 Section "Glazing"

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
 1. Grade: Premium.
 2. Finish: WDMA TR-6 and AWS system 11 catalyzed polyurethane.
 3. Staining: As selected by Architect.
 4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
 5. Sheen: Satin

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated doors according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and commissioning activities and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated door according to NFPA 80, Section 5.2.
- C. Commissioning: Commissioning of all doors shall be performed by the installer supervised by an Architectural Hardware Consultant who is thoroughly knowledgeable of the various components and systems. Include the following:
 - 1. Testing of opening force, closing device, complete closure of the door within clearance tolerances, and full engagement of latch(es) where required by door type.
 - 2. Verify cleanliness of labels, fusible links and other components that cannot be painted.
 - 3. Functional testing of automatic-closing or power-operated fire door assemblies and electrically controlled latching hardware or release devices shall be coordinated with all components of the electrically controlled system.
 - 4. After all doors have been commissioned and prior their acceptance, the Architect, in consultation with the Owner, will select doors (at least one for each operational type) whose full range operation shall be demonstrated by the Contractor to the satisfaction of the Architect.
- D. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- E. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- F. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

3.4 Prepare and submit commissioning report of all doors.

3.5 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

SECTION 08 3113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall access doors and frames for interior locations.
2. Fire-rated wall access doors and frames for interior locations
3. Ceiling access doors and frames for interior locations.
4. Fire-rated ceiling access doors and frames for interior locations.

B. Locations and Quantities of Access Doors: Not all access doors are shown on the Drawings. It is the intent of this section that access doors be provided wherever access is required for operation and maintenance of concealed equipment, dampers, valves, controls or similar devices.

C. Cylinders for access doors are specified in Division 08 Section "Door Hardware."

D. Related Requirements:

1. Division 07 Section "Roof Accessories" for roof hatches.
2. Division 23 Section "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Samples: For each door face material, at least 3 by 5 inches (75 by 125 mm) in size, in specified finish.

D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.3 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
 2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 PRODUCTS, GENERAL

- A. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Babcock-Davis.
 2. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 3. Karp Associates, Inc.
 4. Larsen's Manufacturing Company.
 5. Milcor Inc.
 6. Nystrom, Inc.
- B. Flush Access Doors, with Exposed Trim, for CMU Surfaces: Units consisting of frame with exposed trim, door, hardware, and complying with the following requirements
1. Basis-of-Design Product: Nystrom Model NT, Universal Flush Access Door.
 2. Assembly Description: Fabricate door to fit flush to frame. Provide flange integral with frame, 1 inch wide, overlapping surrounding finished surface.
 3. Locations: Provide at non-rated concrete block walls.
 4. Uncoated Steel Sheet for Door: Nominal 16 gage.
 - a. Finish: Factory prime.
 5. Stainless-Steel Sheet for Door for Toilet Rooms, Shower Rooms, and Other Wet Areas: Nominal 16 gage; No. 4 finish.
 6. Frame Material: Nominal 0.060 inch (1.52 mm), 16 gage
 7. Hinges: Concealed continuous piano hinge.
 8. Locks: Provide with mortise lock prep.
- C. Trimless, Flush Access Doors for Gypsum Board Surfaces: Units consisting of frame, concealed edge trim, door, hardware, and complying with the following requirements:

1. Basis-of-Design Product: Nystrom Model NW or equal.
 2. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
 3. Locations: Provide at non-rated gypsum board walls and ceilings.
 4. Uncoated Steel Sheet for Door: Nominal 16 gage.
 - a. Finish: Factory prime.
 5. Stainless-Steel Sheet for Door for Toilet Rooms, Shower Rooms, and Other Wet Areas: Nominal 16 gage; No. 4 finish.
 6. Frame Material: Nominal 0.060 inch (1.52 mm), 16 gage.
 7. Hinges: Concealed continuous piano hinge.
 8. Locks: Provide with mortise lock prep.
- D. Recessed Doors for Acoustical Ceiling Tiles: Units consisting of frame with no exposed trim, recessed door to receive tile, hardware, and complying with the following requirements.
1. Basis-of-Design Product: Karp, Model DSC-210, Recessed Acoustical Ceiling Tile Access Doors.
 2. Locations: Provide at non-rated acoustical ceilings tiles.
 3. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage thick steel sheet; recessed 1-inch (25.4 mm).
 - a. Finish: Factory prime.
 4. Stainless-Steel Sheet for Door for Toilet Rooms, Shower Rooms, and Other Wet Areas: Nominal 0.060 inch (1.52 mm), 16 gage; No. 4 finish.
 5. Frame Material: Nominal 0.074 inch (1.9 mm), 14 gage.
 6. Hinges: Concealed, pivoting-rod type.
 7. Locks: Provide with mortise lock prep.
- E. Insulated, Fire-Rated Access Doors for Drywall Walls and Ceilings: Units consisting of frame with gypsum board bead concealed edge trim, self-latching insulated door, and hardware, and complying with the following requirements:
1. Basis-of-Design Product: Nystrom Model IW, Insulated Fire Rated Access Door, with Drywall Bead, for Walls and Ceilings.
 2. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release.
 3. Locations: Provide at rated gypsum board walls and ceilings.
 4. Fire-Resistance Ratings:
 - a. Walls: 1-1/2 hours.
 - b. Ceilings: 3 hours.
 5. Uncoated Steel Sheet for Door: 20 ga., 0.0359-inch- (0.91-mm-) thick steel sheet, welded pan type, filled with 2-inch (50 mm) thick fire-rated mineral-fiber insulation.
 - a. Finish: Factory prime.

6. Stainless-Steel Sheet for Door for Toilet Rooms, Shower Rooms, and Other Wet Areas: Same gage and style as steel door; with No. 4 finish.
 7. Frame Material: 16 ga., 0.0598-inch- (1.52-mm-) thick steel sheet, 1-inch (25.4 mm) wide, surrounded by galvanized drywall bead.
 8. Hinges: Concealed continuous piano hinge.
 9. Locks: Provide with mortise lock prep.
- F. Insulated, Fire-Rated Access Doors for CMU Walls: Units consisting of frame with exposed edge trim, self-latching insulated door, and hardware, and complying with the following requirements:
1. Basis-of-Design Product: Nystrom Model IT, Insulated Fire Rated Access Door, with Exposed Flange, for Walls and Ceilings.
 2. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide flange integral with frame, 1 inch (25 mm) wide, overlapping surrounding finished surface. Provide self-latching door with automatic closer and interior latch release.
 3. Locations: Provide at rated concrete block walls.
 4. Fire-Resistance Ratings:
 - a. Walls: 1-1/2 hours.
 5. Uncoated Steel Sheet for Door: 20 ga., 0.0359-inch- (0.91-mm-) thick steel sheet, welded pan type, filled with 2-inch (50 mm) thick fire-rated mineral-fiber insulation.
 - a. Finish: Factory prime.
 6. Stainless-Steel Sheet for Door for Toilet Rooms, Shower Rooms, and Other Wet Areas: Same gage and style as steel door; with No. 4 finish.
 7. Frame Material: 16 ga., 0.0598-inch- (1.52-mm-) thick steel sheet, 1-inch (25.4 mm) wide exposed trim.
 8. Hinges: Concealed continuous piano hinge.
 9. Locks: Provide with mortise lock prep.

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. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.
- E. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
- F. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

- G. Frame Anchors: Same type as door face.
- H. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- I. Mortise locks are specified in Section 087100.

2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish 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 board securely attached to perimeter of frames.
 - 2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
 - 3. Provide mounting holes in frames for attachment of units to metal or wood framing.
 - 4. Provide mounting holes in frame for attachment of masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. Cylinder and keys are specified in Section 087100 "Door Hardware."

2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, VOC-free, electrostatic-applied powder coat finish immediately after surface preparation and pretreatment.

E. Stainless-Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 3113

SECTION 08 3450 - ELEVATOR DOOR SMOKE CONTAINMENT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes smoke detector activated elevator door smoke containment curtain and control system designed to provide a tight- fitting, smoke- and draft- control assembly.
- B. Related Sections include the following:
 - 1. Division 14 Section "Hydraulic Elevators" for coordination with the door opening.
 - 2. Division 26 Electrical Sections for 120v and control circuit power including conduit, boxes, conductors, wiring devices, and emergency power.
- C. Products Supplied but Not Installed under this Section:
 - 1. End-of-line diode (3.9V, 2W). Installed at smoke detector to monitor the circuit.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include door width and height, jamb width, jamb and head projection, curtain width, mounting height, housing width, and motor locations. Show and identify related work performed under other Sections of these Specifications.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each elevator door smoke containment system, signed by product manufacturer.
- B. Qualification Data: For Manufacturer and Installer.
- C. Product Test Reports: Based on evaluation of manufacturer's tests performed by a qualified testing agency, for each elevator door smoke containment system.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For elevator door smoke containment systems to include in operation and maintenance manuals.

- B. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Standards: Manufacturer shall maintain a quality control program in accordance with ICC-ES Acceptance Criteria AC 77.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of systems for this Project.
- C. Manufacturer's Qualifications: Minimum five (5) years experience in producing smoke containment systems of the type specified.
- D. Source Limitations: Obtain all components of elevator door smoke containment system, including operators and controls, through one source from a single manufacturer.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
- F. Certifications:
 - 1. Manufacturer's ICC Evaluation Report ESR-1136.
 - 2. Testing Laboratory Label.
 - 3. UL Listing.

1.6 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of elevator door smoke containment systems that fail in materials or workmanship within specified warranty period.
 - 1. Failure include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Faulty operation of operators and hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period: One (1) year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: The design for the elevator door smoke containment systems is based on Model 600 manufactured by Smoke Guard Corporation. Subject to compliance with requirements, provide the named product or an approved equivalent product.

2.2 PERFORMANCE REQUIREMENTS

- A. Air Leakage: Not to exceed 3 cfm per sf of door opening at 0.1 in. water pressure differential at ambient temperature and 400 deg. F tested per IBC 2012.

2.3 COMPONENTS

- A. Screen:
 - 1. Film: Minimum 1 mil thick transparent polyamide film reinforced with 100 denier nomex yarn at 0.25 in. each way.
 - 2. Magnetic Strips: Flexible multi-pole strips attached to longitudinal edges of film with low modulus silicone adhesive.
- B. Housing: 20-gage stainless steel container and door with concealed hinges, and latch.
- C. Auxiliary Rails:
 - 1. Material: 16-gage, ASTM A 240/240M, Type 430, ferritic stainless steel.
 - 2. Size: 2-inch wide by depth required to project beyond face of elevator door frame, unless otherwise indicated.
- D. Rewind Motor: Top mount, NFPA 70.
- E. Release Mechanism: Comply with UL Standard No. 864.
- F. Control Station: Metal box in housing with battery backup, power disconnect with integral circuit breaker, step down power transformer (120v AC to 24v DC), and controller circuit board.
 - 1. Emergency Power Supply: 12v DC battery with charger.
- G. Screen Rewind Switch: Provide switch to rewind screen into housing, system status indicators, keyed screen deployment test switch, and keyed to silence function.

2.4 IDENTIFICATION

- A. Label each smoke containment system with following information:
 - 1. Manufacturer's name.
 - 2. Maximum leakage rating at specified pressure and temperature conditions.
 - 3. Label of quality control agency.

2.5 STAINLESS STEEL FINISHES

- A. General: Remove or blend stretch lines and tool and die marks into finish.

1. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- B. Satin Finish: No. 4.
- C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, supports, and other conditions affecting performance of elevator door smoke containment systems.
 1. Verify related work performed under other Sections is complete and in accordance with approved Shop Drawings.
 2. Verify wall surfaces and elevator door frames are acceptable for installation of smoke containment system components.
 3. If applicable, verify existing field painted elevator door frames to be used for curtain adherence have been repainted in accordance with smoke containment system manufacturer's instructions or they have the original factory paint.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Do not install damaged components.
- B. Install smoke containment system components plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's installation instructions, Contract Drawings, and approved Shop Drawings..

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent inspecting agency to perform field tests and inspections and prepare test reports. Follow manufacturer's cycle test procedures.
 1. Notify Owner's Representative, local Fire Marshal, alarm sub-contractor and elevator service company minimum one (1) week in advance of scheduled testing.
 2. Complete maintenance service record.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and adjust operating hardware items just before final inspection. Leave work in complete and proper operating condition.
- B. Remove and replace defective work, including defective or damaged curtains, housings, rails, bases, and frames that are warped, bowed, or otherwise unacceptable.
- C. Clean all surfaces promptly after installation. Remove excess sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.

3.5 STARTUP SERVICE

- A. 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 safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Test elevator door smoke containment system closing mechanism activated by detector or alarm-connected fire-release system. Reset elevator door smoke containment system closing mechanism after successful test.

3.6 DEMONSTRATION AND TESTING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain elevator door smoke containment systems.
- B. Perform the following maintenance and testing during the warranty period; provide test documentation to Owner.
 - 1. Perform minimum semi-annual maintenance and testing on each smoke containment system as required by the manufacturer's warranty, code agency evaluation reports, and as required by local authority having jurisdiction.
 - 2. Backup Battery: Test semi-annually during warranty period.

END OF SECTION 08 3450

SECTION 08 4113 - ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior storefront systems.

B. Related sections include the following:

1. Division 07 Section "Joint Sealants" for joint sealants installed as part of aluminum entrance and storefront systems.
2. Division 08 Section "Aluminum Windows" for operable vents inserted in storefront framing.
3. Division 08 Section "Glazing."

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
4. Dimensional tolerances of building frame and other adjacent construction.
5. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferred to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.

B. Structural Loads:

1. Wind Loads: Resist wind positive and negative pressures calculated according to International Building Code and Building Code of New York State, Section 1609:
 - a. Exterior Wind Loading Code Criteria: As indicated on Structural Drawings.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below to less than 1/8 inch (3.2 mm) and clearance between members and operable units directly below to less than 1/16 inch (1.5 mm).
- D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence 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. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.
- G. Water Penetration Under Static Pressure: Provide aluminum-framed systems 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 10 psf for insulating glass framing.
1. Maximum Water Leakage: No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.
- H. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 62 for insulating glass framing when tested according to AAMA 1503
- I. Average Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having average U-factor of not more than 0.31 for fixed framing when tested according to AAMA 1503.

1.3 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.
- B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
 - 3. Include windows inserted in storefront framing system.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Fabrication Sample: Of each vertical-to-horizontal intersection of systems, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
 - 1. Joinery.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and field testing agency.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems
- C. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- D. Warranties: Special warranties specified in this Section.
- E. Field test reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
 - 1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this

Project and submission of reports of tests performed on manufacturer's standard assemblies.

- B. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025 and acceptable to Owner and Architect.
- C. Source Limitations: Obtain all entrance and storefront systems, curtainwall framing, windows, and non-rated aluminum doors and frames, for the entire project through one source and from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of entrance and storefront systems and are based on the specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 for substitutions.
 - 1. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of entrance and storefront systems that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 - 1. Warranty Period: 3 years from date of Substantial Completion.
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of system to meet performance requirements.
 - c. Failure of operating components to function normally.
 - d. Water leakage through fixed glazing and frame areas.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
 - a. Deterioration of metal finishes beyond normal weathering.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. EFCO Corporation.
2. Kawneer, an Arconic company.
3. YKK USA

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 (ASTM B 221M).
 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 4. Bars, Rods, and Wire: ASTM B 211 (ASTM B 211M).
 5. Welding Rods and Bare Electrodes: AWS A5.10.
- B. Steel Reinforcement: Complying with ASTM A 36 (ASTM A 36M) for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 (ASTM A 570M) for hot-rolled sheet and strip.
- C. Glazing as specified in Division 08 Section "Glazing."
- D. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
- E. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.
- F. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.
- G. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 07 Section "Joint Sealants."

- H. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.3 COMPONENTS

- A. Exterior Storefront Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads. Provide outside captured pressure-plate type framing systems as indicated.
 - 1. Thermal-Break Construction: Composite assemblies of two separate extruded-aluminum components permanently bonded by a structural poured-in-place, two-part polyurethane, dual pour and debridge type.
 - 2. Minimum thickness of aluminum frame extrusions shall be 0.080".
 - 3. Dimensions of Framing Members: Provide framing with vertical and horizontal framing members having a nominal face dimension of 2 inches, and overall depth of 4-1/2 inches.
 - 4. Finish: two or three-coat PVDF paint, in color selected by Architect, and to match curtainwall framing.
 - 5. Basis of Design Products: Subject to compliance with requirements, provide 403X Dual-Thermal Flush Glazed Storefront by EFCO Corp., or equal product by one of the following:
 - a. Kawneer Company, Inc., an Arconic company
 - b. YKK USA
- B. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Reinforce members as required to retain fastener threads.
 - 2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.
- D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.
- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing, compatible with adjacent materials, and of type recommended by manufacturer.
- F. Insulating Materials: Provide fiberglass batts for stuffing in openings and cracks.

2.4 FABRICATION

- A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
 - 1. Fabricate components for screw-spline frame construction or shear-block frame construction as recommended by storefront manufacturer for field conditions.
- B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
- C. Prepare components to receive concealed fasteners and anchor and connection devices.
- D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. 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.
- F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to GANA's "Glazing Manual."
- G. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Storefront: Fabricate framing in profiles indicated. Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- I. Prefabrication: Complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible before shipment to the Project site. Disassemble components only as necessary for shipment and installation.
 - 1. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces. Complete these operations for hardware prior to application of finishes.
 - 2. Do not preglaze framing system. Refer to Division 08 Section "Glazing" for specifications.
- J. Welding: Comply with AWS recommendations. Grind exposed welds smooth to remove weld spatter and welding oxides. Restore mechanical finish.
 - 1. Welding behind finished surfaces shall be performed in such a manner as to minimize distortion and discoloration on the finished surface.

- K. Reinforcing: Install reinforcing as required for hardware and as necessary for performance requirements, sag resistance and rigidity.
- L. Dissimilar Metals: Separate dissimilar metals with bituminous paint, or a suitable sealant, or a nonabsorptive plastic or elastomeric tape, or a gasket between the surfaces. Do not use coatings containing lead.
- M. Continuity: Maintain accurate relation of planes and angles with hairline fit of contacting members.
- N. Fasteners: Conceal fasteners wherever possible.

2.5 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- 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 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.
- C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- D. Two or Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coats and if required, clear top coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color: As selected by Architect from manufacturer's full range, and to match curtainwall framing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

- B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 7 Section "Joint Sealants."
 - 1. Install sill flashings with allowance for expansion and contraction at 12 feet on center. Seal expansion joint with manufacturer's recommended pliable sealing tape.
- E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
- F. Install operable vents to comply with requirements of Division 08 Section "Aluminum Windows," unless otherwise indicated.
- G. Install glazing to comply with requirements of Division 08 Section "Glazing," unless otherwise indicated.
- H. Install perimeter sealant to comply with requirements of Division 07 Section "Joint Sealants," unless otherwise indicated.
- I. Install insulation materials in locations indicated, and at head and jamb of storefront system stuffed into openings, held above sill 1 inch (25 mm).
- J. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:
 - 1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
 - 2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm). Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
 - 3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Test Area: Perform tests on representative areas of glazed aluminum entrance and storefront framing where directed by Architect.

- C. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum entrance and storefront framing:
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - 2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. (0.45 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - 3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.
- D. Glazed aluminum entrance and storefront framing will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.4 ADJUSTING AND CLEANING

- A. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.5 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 4113

SECTION 08 4126 - ALL-GLASS ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior all-glass storefront systems.
- B. Related Sections include the following:
 - 1. Division 07 Section "Joint Sealants" for joint sealants installed at interface of all-glass systems and other building components.
 - 2. Division 08 Section "Fire-Rated Aluminum Storefront and Entrances" for door and frames adjacent to all glass storefront.

1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details, including the following:
 - 1. Plans, elevations, and sections.
 - 2. Details of fittings and glazing.
 - 3. Interface with adjacent aluminum and glass doors and frames.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Finishes: 6-inch- (150-mm-) long sections of patch fittings, rails, and other items.
 - 2. Glass: 6 inches (150 mm) square, showing exposed-edge finish.

1.3 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with all-glass systems by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating all-glass systems without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of all-glass systems that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Structural failures.
 - 2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 3. Failure of operating components to function normally.
- B. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: The design for all-glass systems is based on CRL DRS Dry Glaze Sidelite Rail System manufactured by C. R. Laurence Company, Inc. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 - 1. ACI Distribution.
 - 2. Arch Aluminum & Glass Co., Inc.
 - 3. DORMA
 - 4. Guardian Industries Corp./Float Glass Division.
 - 5. J.E. Berkowitz, LP.
 - 6. RACO
 - 7. Virginia Glass Products Corp.

2.2 MATERIALS

- A. Glass: ASTM C 1048, Class 1 (clear), Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), tested for surface and edge compression per ASTM C 1048 and for impact strength per 16 CFR 1201 for Category II materials.
 - 1. Thickness: As required by system engineering calculations; minimum 3/8"
 - 2. Exposed Edges: Polished and chamfered.
 - 3. Butt Edges: Flat ground.
 - 4. Glazing Gaskets: Black
- B. Aluminum: ASTM B221 (ASTM B221M), Alloy 6063, T5 Temper.

2.3 COMPONENTS

- A. Frameless Glazed Interior Wall Assembly: Factory fabricated assemblies consisting of full-width and height glass panels fastened with low profile sidelite aluminum rail fittings on top and bottom edge of glass wall. System shall be dry glazed using manufacturer's standard glazing gaskets.
 - 1. Full Length Bottom Rails: 4 inch high by 2 inch deep with end caps and square profile.
 - 2. Full Length Header: 4 inch high by 2 inch deep with end caps and square profile
 - 3. Material: Aluminum
 - 4. Finish: Clear anodized
 - 5. Glazing: Tempered glazing, minimum 3/8" thick.
 - 6. Glazing Gaskets:
 - a. Bottom Rails: Aluminum and neoprene setting blocks.
 - b. Top Rails: Top load EPDM roll-in glazing gasket.
 - 7. Basis of Design System: CRL DRS Dry Glaze Sidelite Rail System manufactured by C. R. Laurence Company, Inc.
- B. Accessories: Provide all accessories as required for complete installation.
 - 1. Glazing Gaskets/Strips for Glass Butt Joints: Provide CRL Clear Copolymer Strip for 180 Degree Glass-to-Glass Joints - 3/8" (12mm) Tempered Glass by CR Laurence Co., or equal.

2.4 FABRICATION

- A. Provide holes and cutouts in glass to receive hardware, fittings, rails, and accessories before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.
- B. Factory assemble components and factory install hardware to greatest extent possible..

2.5 ALUMINUM FINISH

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install all-glass systems and associated components according to manufacturer's written instructions.
- B. Set units level and plumb.
- C. Maintain uniform clearances between adjacent components.
 - 1. Provide uniform gap between glass panels. Install clear copolymer glazing gaskets/strips between glass panels as per manufacturer's directions at all butt joints in glazing.

3.3 ADJUSTING AND CLEANING

- A. Remove excess sealant and glazing compounds and dirt from surfaces.

END OF SECTION 08 4126

SECTION 08 4413 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Glazed aluminum curtain wall, 2-sided and 4-sided structural silicone glazed.
 - 2. Glazed aluminum curtain wall, captured 4 sides..
 - 3. Manual-swing aluminum doors and door frames.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 07 Section "Joint Sealants" for joint sealants installed as part of glazed aluminum curtain wall system.
 - 2. Division 08 Section "Glazing."

1.2 ACTION SUBMITTALS

- A. Product Data for each product specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop Drawings prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of glazed aluminum curtain-wall systems.
 - 1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 - 2. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior
 - 3. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations. Indicate routing of wiring for electrified hardware in vertical members.
- C. Delegated-Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Cutaway Sample of each vertical-to-horizontal intersection of system, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
 - 1. Joinery.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Installer.
2. For field testing agency.
3. 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. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

C. Product test reports from a qualified independent testing agency evidencing compliance of glazed aluminum curtain wall system with requirements based on comprehensive testing of manufacturer's current system.

D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.

E. Sample Warranties: For special warranties.

F. Field test reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.5 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the 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 glazed aluminum curtain wall systems that are similar to those indicated for this Project in material, design, and extent.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025 and acceptable to Owner and Architect.

- D. Source Limitations: Obtain glazed aluminum curtain wall system and aluminum-framed entrance doors and framing from one source and by a single manufacturer for the Project.
- E. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."
 - 1. Engage welders who have satisfactorily passed AWS qualification tests for welding processes involved and who are currently certified for these processes.
- F. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of structural-sealant-glazed curtain wall assemblies.
- G. Mockups: Prior to installing glazed aluminum curtain wall system, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for Work.
 - 1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
 - 2. Include glazing in mock-up.
 - 3. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Obtain Architect's approval of mockups before start of Work.
 - 6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.
- H. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to glazed aluminum curtain wall system including, but not limited to, the following:
 - 1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 - 2. Review structural loading limitations.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review required inspecting, testing, and certifying procedures.
 - 5. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions.
 - 6. Review requirements for coordinating installation of curtainwall framing with installation of electrical wiring and electrified hardware concealed in framing members

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.7 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of a glazed aluminum curtain wall system that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 - 1. Warranty Period: 10 years from date of Substantial Completion for:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of system to meet specified performance requirements.
 - c. Failure of operating components to function normally.
 - d. Water leakage through fixed glazing and frame areas.
 - e. Sealant failure.
 - f. Excessive noise or vibration of system
 - 2. Warranty Period: 20 years from date of Substantial Completion.
 - a. Deterioration of metal finishes beyond normal weathering.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in "Quality Assurance" Article above, to design glazed aluminum curtain walls.
- B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

2. Glazed aluminum curtain wall system, including anchorage, shall accommodate dimensional tolerances of building frame and other adjacent construction.
 3. 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.
 - f. Sealant failure.
- C. Structural Loads:
1. Wind Loads: As indicated on Structural Drawings.
 2. Other Design Loads: As indicated on Structural Drawings
- D. Deflection of Framing Members:
1. Limited to 1/175 of clear span for spans of up to 13 feet 6 inches (4.1 m).
 2. Limited to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans of greater than 13 feet 6 inches (4.1 m)
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Duration: As required by design wind velocity, but not less than 10 seconds.
- F. Air Infiltration: Provide glazed aluminum curtain wall system with permanent resistance to air leakage through system of not more than 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft.
1. Provide not more than 0.50 cfm/lin. ft. and 1.0 cfm/lin. ft. of perimeter crack for single (3'-0" x 7'-0") door and pair of doors (6'-0" x 7'-0") respectively, when tested in accordance with ASTM E 283 at a static-air-pressure difference of 6.24 psf and 1.57 lbf/sq. ft. respectively
- G. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft.
- H. Thermal Movements: Provide glazed aluminum curtain wall system, including anchorage, that accommodates thermal movements of system and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without

buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, noise or vibration, and other detrimental effects.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- I. Condensation Resistance: Provide condensation-resistance factor (CRF) of not less than the amounts indicated below when tested according to AAMA 1503.1.
 1. Provide aluminum curtain wall system with condensation-resistance factor (CRF) of not less than 74 for fiberglass pressure plate construction and 61 for SSG.
- J. Average Thermal Conductance: Provide glazed aluminum curtain wall system with an average U-value of not more than 0.32 Btu/sq. ft. x h x deg F when tested with a glass COG U-factor of .24, according to AAMA 1503.1.
- K. Structural-Sealant Joints: Designed to carry gravity loads of glazing.
- L. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
 1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 MANUFACTURERS

- A. Manufacturers: Provide specified products of EFCO Corporation or equivalent products. Acceptable manufacturers include, but are not limited to, one of the following manufacturers, or equal:
 1. Kawneer Company, Inc., an Arconic Company
 2. YKK AP America Inc.

2.3 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
 1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 (ASTM B 221M).
 3. Extruded Structural Pipe and Tubes: ASTM B 429.

- B. Steel Reinforcement: ASTM A 36 (ASTM A 36M) for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 (ASTM A 570M) for hot-rolled sheet and strip.
- C. Glazing as specified in Division 08 Section "Glazing."
- D. Glazing Gaskets: EPDM sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers; in hardness recommended by manufacturer.
- E. Glazing sealants and fillers as specified in Division 08 Section "Glazing."
- F. Framing system gaskets and joint fillers as recommended by manufacturer for joint type.
- G. Sealants and joint fillers for joints within glazed aluminum curtain wall system as specified in Division 07 Section "Joint Sealants."
- H. Firestop materials as specified in Division 07 Section "Firestop Joint Systems."
- I. Insulating Materials: Provide fiberglass batts for stuffing in openings and cracks as specified in Division 07 Section "Building Insulation."
- J. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.4 COMPONENTS

- A. Curtain Wall System and Entrance Framing: Manufacturer's standard extruded-aluminum framing members for multi-story curtainwall application of thickness required and reinforced as required to support imposed loads. Provide outside glazed system, with fiberglass pressure plate, captured horizontal and vertical mullions, and 2-sided and 4-sided structural silicone glazed joints.
 - 1. Two-sided and 4-sided structural glazed curtain wall shall include a dense silicone spacer and silicone sealant at the structural joint. Two-sided system can be captured horizontally by means of an exterior fiberglass pressure plate and snap cover, which shall be dry glazed using an interior and exterior dense EPDM preset gasket.
 - 2. Pressure plate shall be fabricated from fiberglass composite with a flexural strength of no less than 82 ksi along the lineal's major axis.
 - 3. Aluminum vertical and horizontal main frame extrusions shall have a minimum wall thickness of .093" to .125" .
 - 4. Frame components shall be mechanically fastened by means of extruded aluminum shear blocks attached to vertical mullions.
 - 5. Provide custom fin-shaped exterior caps on vertical framing members.
 - 6. Provide entrance framing members compatible with glass framing in appearance and provide single acting entrance frames with positive barrier weathering

7. Provide heavy wall entrance door frames fabricated from minimum 0.188-inch- thick aluminum framing at door frames for 2" heavy wall doors.
 8. Dimensions of Framing Members: Provide framing with vertical and horizontal framing members having a nominal face dimension of 2-1/2 inches, and overall depth of 6 inches, as indicated on Drawings.
 9. Basis of Design Product: 5600 series; EFCO Corp., or one of the following:
 - a. 1600 Wall System ; Kawneer Company, Inc.
 - b. YCW750; YKK
- B. Doors: Manufacturer's standard glazed doors, for manual swing operation.
1. Construction: 2-inch (50.8-mm) overall thickness, with minimum 0.188-inch- (4.8-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded.
 2. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets. Provide nonremovable glazing stops on outside of door
 3. Door Design: Wide stile; 5 inches wide.
 - a. Top Rail: 6-1/2 inches (165.1 mm) wide.
 - b. Mid Rail (Where indicated): 6-inches (150 mm) wide.
 - c. Bottom Rail: 10-1/4 inches (260 mm) wide
 4. Basis of Design Products: Subject to compliance with requirements, provide. Durastile Wide Stile; EFCO Corp., or one of the following in dimensions indicated above:
 - a. 500 Tuffline Entrances; Kawneer Company, Inc
 - b. Model 40M Monumental Door by YKK.
- C. Brackets and Reinforcements: Provide manufacturer's standard high-strength aluminum brackets and reinforcements. Provide nonstaining, nonferrous shims for aligning system components.
- D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Finish exposed portions to match glazed aluminum curtain wall.
1. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended by manufacturer.
 2. Where fasteners anchor into aluminum less than 0.125 inch (3.2 mm) thick, provide reinforcement to receive fastener threads.
 3. Use concealed fasteners, unless otherwise indicated.
- E. Anchors: 3-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

- F. Concealed Flashing: Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, complying with ASTM A 666, of type selected by manufacturer for compatibility with system.

2.5 HARDWARE

- A. General: Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for entrances indicated. Finish exposed parts to match door finish, unless otherwise indicated. All hardware shall be ANSI 117.1-2017 compliant.
- B. Continuous Gear Hinges: Manufacturer's standard heavy-duty continuous gear hinge with aluminum bearings between knuckles; fabricated to full height of door and frame.
 - 1. Provide Hagar Roton Model #780-226 HD Series Heavy Duty UL Listed, concealed geared hinge, for 2" thick doors. No substitutions will be accepted.
- C. Surface-Mounted Overhead Closers: Install units specified in Division 08 Section "Door Hardware."
- D. Door Stops: Install units specified in Division 08 Section "Door Hardware."
- E. Panic Devices: Install units specified in Division 08 Section "Door Hardware."
- F. Cylinders: Install units specified in Division 80 Section "Door Hardware."
- G. Thresholds: At exterior doors, provide manufacturer's standard thermally broken threshold with cutouts coordinated for operating hardware, with anchors and jamb clips, and not more than 1/2-inch- (12.7-mm-) high, with beveled edges providing a floor level change with a slope of not more than 1:2, and in the following material:
 - 1. Material: Aluminum, mill finish.
- H. 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, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- I. Weather Sweeps: Manufacturer's standard weather sweep for application to exterior door bottoms and with concealed fasteners on mounting strips.

2.6 CURTAINWALL FABRICATION

- A. General: Fabricate glazed aluminum curtain wall system according to Shop Drawings. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

- B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
- C. Prepare components to receive concealed fasteners and anchor and connection devices.
- D. Fabricate components to drain water passing joints, condensation occurring in glazing channels, condensation occurring within framing members, and moisture migrating within the system to the exterior.
- E. Glazing Pockets: Provide minimum clearances for thickness and type of glass indicated according to GANA's "Glazing Manual."
- F. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- G. Frame Units: Factory assemble frame units according to Shop Drawings to greatest extent possible. Rigidly secure nonmovement joints. Seal joints watertight, unless otherwise indicated. Assemble components to drain water passing joints, condensation occurring in glazing channels, condensation occurring within framing members, and moisture migrating within the system to the exterior.
- H. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.
 - 1. Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.
 - 2. At exterior door bottom rail, provide an EPDM blade gasket sweep strip applied with concealed fasteners
- I. Prefabrication: Complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible before shipment to the Project site. Disassemble components only as necessary for shipment and installation.
 - 1. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces. Complete these operations for hardware prior to application of finishes.
 - 2. Do not drill and tap for surface-mounted hardware items until time of installation at project site. Refer to Division 08 Section "Door Hardware" for additional hardware installation requirements.
 - 3. Preglaze doors but do not preglaze framing system. Refer to Division 08 Section "Glazing" for specifications.
- J. Reinforcing: Install reinforcing as required for hardware and as necessary for performance requirements, sag resistance and rigidity.

2.7 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- 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 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.
- C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes
- D. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Fluoropolymer Two or Three-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat and if required, clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - a. Color(s): As selected by Architect from manufacturer's full range, and to match metal wall panels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of glazed aluminum curtain wall system. Do not proceed with installation until unsatisfactory conditions have been corrected or accommodations acceptable to Architect have been made.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing glazed aluminum curtain wall system. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight, unless otherwise indicated. Provide means to drain water to the exterior to produce a permanently weatherproof system.
- B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape

recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- C. Install components to drain water passing joints, condensation occurring in glazing channels, condensation occurring within framing members, and moisture migrating within the system to the exterior.
- D. Install factory-assembled frame units plumb and true in alignment with established lines and grades.
- E. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.
 - 1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible
- F. Anchorage: After system components are positioned, fix connections to building structure as indicated on Shop Drawings.
 - 1. Provide separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- G. Install glazing according to Shop Drawings. Comply with requirements of Division 08 Section "Glazing," unless otherwise indicated.
- H. Install sealant according to Shop Drawings. Comply with requirements of Division 07 Section "Joint Sealants," unless otherwise indicated.
- I. Install insulation materials in locations indicated, and at perimeter of curtainwall system stuffed into openings. Comply with requirements of Division 07 Section "Building Insulation," unless otherwise indicated.
- J. Install firestop in locations indicated. Comply with requirements of Division 07 Section "Firestop Joint Systems," unless otherwise indicated.
- K. Erection Tolerances: Install glazed aluminum curtain wall system to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet (3 mm in 3 m); 1/4 inch in 40 feet (6 mm in 12 m).
 - 2. Level: 1/8 inch in 20 feet (3 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).
 - 3. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm); where a reveal or protruding element separates aligned surfaces by less than 2 inches (50.8 mm), limit offset to 1/2 inch (12.7 mm).
 - 4. Location: Limit variation from plane or location shown on Shop Drawings to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/2 inch (12.7 mm) over total length.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Test Area: Perform tests on representative areas of glazed aluminum curtain walls where directed by Architect.
- C. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls:
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - 2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. (0.45 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - 3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.
 - 4. Structural-Sealant Adhesion: Test structural sealant in accordance with recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 - a. Test a minimum of six areas on each building facade.
 - b. Repair installation areas damaged by testing.
- D. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.4 ADJUSTING AND CLEANING

- A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure
- B. Clean exposed surfaces of systems that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not allow soil to accumulate until final cleaning.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

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

- 1. Touch-up minor abrasions with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.5 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure glazed aluminum curtain wall system is without damage or deterioration at the time of Substantial Completion.

3.6 HARDWARE SCHEDULE - Refer to Section 08 7100

END OF SECTION 08 4413

SECTION 08 5113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes aluminum windows of the performance class and grade indicated. Window types required include the following:
 - 1. Project-out, awning.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 08 Section "Aluminum Entrances and Storefronts."
 - 2. Division 08 Section "Glazing."
 - 3. Division 08 Section "Security Screens."

1.2 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum windows engineered, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading without failure, as demonstrated by testing manufacturer's standard window assemblies representing types, grades, classes, and sizes required for Project according to test methods indicated.
- B. Test Criteria: Testing shall be performed by a qualified independent testing agency based on the following criteria:
 - 1. Wind Loads: Provide aluminum windows capable of withstanding wind-load design pressures indicated on the Drawings.
 - 2. Test Procedures: Test window units according to ASTM E 283 for air infiltration, ASTM E 331 for water penetration, and ASTM E 330 for uniform load deflection and structural performance.
- C. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Performance Class and Grade: As indicated in the window type in Part - 2 below.
- D. Performance Requirements: Testing shall demonstrate compliance with requirements indicated in AAMA/WDMA/CSA 101/I.S.2/A440 - 08 for air infiltration, water penetration, and structural performance for type, grade, and performance class of window units required.
 - 1. Air-Infiltration Rate: Not more than quantity of cfm/ft. (cu. m/h per m) of operable sash joint for an inward test pressure of as indicated in lbf/sq. ft. (Pa) for the window type in Part - 2 below.

2. Water Penetration: No water penetration as defined in the test method at an inward test pressure indicated in the window type in Part - 2 below.
3. Uniform Load Deflection: No deflection in excess of 1/175 of any member's span during the imposed load, for a positive (inward) and negative (outward) test pressure indicated in lbf/sq. ft. (Pa) for the window type in Part - 2 below.
4. Structural Performance: No failure or permanent deflection in excess of 0.4 percent of any member's span after removing the imposed load, for a positive (inward) and negative (outward) test pressure indicated in lbf/sq. ft. (Pa) for the window type in Part - 2 below.
5. Condensation Resistance: Where window units are indicated to be "thermally improved," provide units tested for thermal performance according to AAMA 1503.1 showing a minimum condensation resistance factor (CRF) as indicated for the window type in Part - 2 below.
6. Thermal Transmittance: Provide window units with a U-value maximum as indicated in Btu/sq. ft. x h x deg F (W/sq. m x K) at 15-mi./h (24-km/h) exterior wind velocity, when tested according to AAMA 1503.1, for the window type in Part - 2 below.
7. Forced-Entry Resistance: Comply with performance grade 10 requirements when tested according to ASTM F 588.
8. Thermal Movements: Provide window units that allow thermal movement resulting from the following maximum change (range) in ambient temperature when engineering, fabricating, and installing aluminum windows to prevent buckling, opening of joints, and overstressing of components, connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.3 ACTION SUBMITTALS

- A. Product Data for each type of window required, including the following:
 1. Construction details and fabrication methods.
 2. Profiles and dimensions of individual components.
 3. Data on hardware, accessories, and finishes.
 4. Recommendations for maintaining and cleaning exterior surfaces.
- B. Shop Drawings showing fabrication and installation of each type of window required including information not fully detailed in manufacturer's standard Product Data and the following:
 1. Layout and installation details, including anchors.
 2. Elevations at 1/4 inch = 1 foot (1:50) scale and typical window unit elevations at 3/4 inch = 1 foot (1:20) scale.
 3. Full-size section details of typical composite members, including reinforcement and stiffeners.
 4. Location of weep holes.
 5. Panning details.
 6. Hardware, including operators.

7. Window cleaning provisions.
8. Glazing details.
9. Accessories.

- C. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.
- D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.
- E. Samples for Verification: 12-inch- (300-mm-) long sections of window members with applied finish. The Architect reserves the right to require additional samples that show fabrication techniques, workmanship, and design of hardware and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Test reports from a qualified independent testing agency indicating that each type, grade, and size of window unit complies with performance requirements indicated based on comprehensive testing of current window units within the last 5 years. Test results based on use of down-sized test units will not be accepted.
- B. Qualification Data:
 1. For Installer to demonstrate their capabilities and experience. Provide evidence of acceptability from manufacturer for installation.
 2. For manufacturer.
 3. For field testing agency.
- C. Field test reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer acceptable to aluminum window manufacturer for installation of units required for this Project, who has completed installation of aluminum windows similar in material, design, and extent to those required for this Project and with a record of successful in-service performance.
- B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.
- C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025 and acceptable to Owner and Architect.
- D. Source Limitations: Obtain all aluminum windows, entrance and storefront systems, non-rated aluminum doors and frames, and curtainwall framing for the entire project through one source and from a single manufacturer.

- E. Product Options: The Drawings indicate sizes, profiles, dimensional requirements, and aesthetic effects of aluminum windows and are based on the specific window types and models indicated. Other aluminum window manufacturers whose products have equal performance characteristics may be considered provided deviations in size, profile, and dimensions are minor and do not alter the aesthetic effect. Refer to Division 01 Section regarding substitutions.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Check window openings by field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty signed by aluminum window manufacturer agreeing to repair or replace window components that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
 - 2. Faulty operation of sash and hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- C. Warranty Period: 5 years after date of Substantial Completion.
- D. Warranty Period for Glass: 10 years after date of Substantial Completion.
- E. Warranty Period for Metal Finishes: 20 years after date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: The drawings are based on windows by EFCO Corporation. Provide specified products or equivalent products by one of the following:
 - 1. YKK
 - 2. Kawneer, an Arconic Company.

2.2 MATERIALS

- A. Aluminum Extrusions: Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength and not less than 0.125 inch thick at any location for main frame and sash members.
- B. Fasteners: Provide aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.
 - 1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard, noncorrosive, pressed-in, splined grommet nuts.
 - 2. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate. Where exposed fasteners are unavoidable, provide tamper-resistant fasteners.
- C. Anchors, Clips, and Window Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel or iron complying with requirements of ASTM B 633; provide sufficient strength to withstand design pressure indicated.
- D. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.
 - 1. Weather-Stripping Material: Manufacturer's standard system and materials.
- E. Sealant: For sealants required within fabricated window units, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating. Comply with Division 07 Section "Joint Sealants" of these Specifications for installation of sealants.

2.3 GLAZING

- A. Provide insulating glass unit of material and thickness as specified in Section 088000.

2.4 HARDWARE

- A. General: Where not indicated, provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum and of sufficient strength to perform the function for which it is intended.

2.5 ACCESSORIES

- A. General: Provide manufacturer's standard accessories that comply with indicated standards.

- B. Insect Screens: Provide insect screens for each operable exterior sash or ventilator as scheduled. Locate screens on inside or outside of window sash or ventilator, depending on window type. Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Provide wickets where indicated.
 - 1. Screen Frames: Fabricate frames of tubular-shaped, extruded- or formed-aluminum members of 0.040-inch- (1-mm-) minimum wall thickness, with mitered or coped joints and concealed mechanical fasteners. Finish frames to match window units.
 - a. Provide removable PVC spline-anchor concealing edge of screen frame.
 - 2. Wire-Fabric: 18-by-16 mesh of 0.011-inch-diameter, coated aluminum wire.
 - a. Color: As selected by Architect.
- C. Sills: Finished to match window. Provide where indicated.
 - 1. Extruded: .125 inch thick extruded aluminum.

2.6 FABRICATION, GENERAL

- A. General: Fabricate aluminum window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units.
 - 1. Provide units that are reglazable without dismantling sash or ventilator framing.
- B. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance, structural thermal barrier, located between exterior materials and window members exposed on interior, in a manner that eliminates direct metal-to-metal contact.
 - 1. Provide thermal-break construction of thermal struts, consisting of glass reinforced polyamide nylon, mechanically crimped in raceways extruded in the interior and exterior extrusions.
 - 2. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.
- C. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- D. Preglazed Fabrication: Preglaze window units at the factory. Comply with glass and glazing requirements of Division 08 Section "Glazing" of these Specifications and AAMA 101.
- E. Fabrication:
 - 1. Frame: 0.125 inch thick extrusions with each corner joined with mechanical fasteners.

2. Vent: 0.125 inch thick tubular members with each corner mitered, gusset reinforced, crimped and sealed.
 3. Provide units incorporating pressure equalization to direct water to the exterior through baffled weep holes and/or compression seals installed in the aluminum extrusion.
 4. Glazing Stops: Provide snap-on glazing stops, coordinated with glass selection and glazing system indicated. Finish to match window units.
- F. Weatherstripping: Provide sliding-type weatherstripping where sash rails slide horizontally or vertically along unit frame. Provide compression-type weatherstripping at perimeter of each operating sash where sliding type is inappropriate.
1. Provide weatherstripping locked into extruded grooves in sash.
- G. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

2.7 PROJECTED WINDOWS (AWNING)

- A. Window Performance Class and Grade: Comply with requirements of AAMA Performance Class and Grade AW-PG120-AP. Window units shall successfully pass life-cycle test requirements specified in AAMA 910.
- B. Hardware: Provide the following equipment and operating hardware:
1. Hinges: 4-bar arm with 4" limit, stainless steel.
 2. Locks: Cast white bronze lift handles, two per sash located one at each jamb.
 3. Pull Handle: Cast white bronze, one at each sash.
- C. Screens:
1. Provide insect screens with wickets at windows located at 2nd Floor and above.
 2. Provide security screens with wickets at windows located at First Floor; refer to Section 08 5656.
- D. Performance Requirements:

PERFORMANCE REQUIREMENTS							
Window Type(s)	Window Grade and Class	Air-Infil. Rate/ @ test pressure	Water Penetr.	Uniform Load Deflect.	Uniform Load Struct.	CRF frame	Thermal Trans.
Awning	AW-PG120	.1 cfm/ ft. of sash @ 6.24	15 psf	120 psf	180 psf	68	.45

- E. Frame Depth: 3-1/4"

- F. Basis of Design Product: EFCO 325X

2.8 FINISHES

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- C. Two or Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coats and if required, clear top coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color: As selected by Architect from manufacturer's full range, and to match curtainwall framing.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect openings before installation. Verify that rough or masonry opening is correct and sill plate is level.
1. Masonry surfaces shall be visibly dry and free of excess mortar, sand, and other construction debris.
2. Metal surfaces shall be dry; clean; free of grease, oil, dirt, rust and corrosion, and welding slag; without sharp edges or offsets at joints.

3.2 INSTALLATION

- A. Comply with manufacturer's specifications and recommendations for installing window units, hardware, operators, and other components of the Work.
- B. Set window units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place.
1. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified under "Dissimilar Materials" Paragraph in appendix to AAMA 101.
- C. Set sill members and other members in a bed of sealant or with joint fillers or gaskets, as shown on Shop Drawings, to provide weathertight construction. Refer to Division 07 Section "Joint Sealants" for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the Work.

1. Sealants, joint fillers, and gaskets to be installed after installation of window units are specified in another Division 07 Section.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Test Area: Perform tests on windows where directed by Architect.
- C. Field Quality-Control Testing: Perform the following test on representative windows:
 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. (0.45 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
 - a. Perform a minimum of three tests in areas as directed by Architect.
 3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.
- D. Windows will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.4 CLEANING

- A. Clean aluminum surfaces promptly after installing windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.
- B. Clean glass of preglazed units promptly after installing windows. Comply with requirements of Division 08 Section "Glazing" for cleaning and maintenance.

3.5 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to aluminum window manufacturer, that ensure window units are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 5113

SECTION 08 5656 - SECURITY SCREENS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes manufactured security screens applied to the interior face of each project-out (awning) aluminum window.

1.2 ACTION SUBMITTALS

- A. Product data for each type of security screen specified, including details of construction relative to materials, dimensions of individual components, operations, test performance, profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation of security screens. Include plans, elevations, component details, and attachments to other Work. Indicate materials and profiles of each member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and other finish characteristics available for.
- D. Samples for Verification: Full size security screen sample. If finishes involve normal color and texture variations, include sample sets, consisting of two or more units, showing the full range of variations expected.

1.3 INFORMATIONAL SUBMITTALS

- A. Certifications that screens comply with impact test, sag test and forced entry resistance test of ANSI/SMA 6001-02 for medium class, and AAMA Notice of Product Certification in compliance with CFR 200.935 as "Security Screen - Medium".
- B. Qualification Data: For installer and manufacturer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Arrange for installation of security screens specified in this Section by a firm authorized by the manufacturer.
- B. Manufacturer Qualifications: A firm experienced in producing security screens similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- C. Mockup: Prepare a mockup of each type of security screen in sizes required and at window locations selected by Architect to demonstrate compliance with requirements specified and to serve as a standard for judging the completed Work.
 - 1. Mockups in good condition as determined by the Architect may be left in place as part of the work at the completion of the Project.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings."
- E. Comply with impact test, sag test and forced entry resistance test of SMA 6001-02, and AAMA "Security Screen - Medium," in compliance with CFR 200.935.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store security screens inside a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating ornamental metal without field measurements. Coordinate other construction to ensure that actual dimensions correspond to established dimensions.

1.7 EXTRA MATERIALS

- A. Extra Materials: Furnished from same production run as security screens installed. Package materials with protective covering and identify with labels describing contents. Deliver extra materials to Owner.
 - 1. Furnish 10 of each size for student rooms.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by Kane Manufacturing Corp. or one of the following:
 - 1. Exeter Architectural Products

2. Harmony Products, Inc.

2.2 MATERIALS

- A. General: Provide metals free from surface blemishes where exposed to view in finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.
- B. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required:
 - 1. Extruded Bars and Shapes: ASTM B 221 (ASTM B 221M), alloy 6063-T6.
 - 2. Extruded Pipe and Tubes: ASTM B 429, alloy 6063-T6.
 - 3. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), alloy 6061-T6.
 - 4. Castings: ASTM B 26/B 26M, alloy A356-T6.
- C. Wire-Cloth Screen: Woven 12-by-12 mesh of 0.028-inch-diameter, type 304 stainless-steel wire double crimped, painted black.

2.3 FABRICATION

- A. Main Frame: Extruded aluminum minimum 1" x 1-1/2" wide, double hollow, "L" shape, weight not less than .422 lbs./ft., with a nominal thickness of .075- inch. Corners shall be mitered, fitted with an internal tension coupling assembly and fastened. Screen frame shall have an integral groove for the retention of a combination cushioning strip/insect shield.
- B. Removable Face Plate: Provide extruded aluminum face plate minimum .050 inch thick, weighing a minimum of .068 lbs./ lin. ft., attached to the sides of the main frame using tamper resistant screws.
- C. Wire cloth shall be hemmed 180 degrees and retained by a removable concealment plate and tamper-resistant screws. Tamper-resistant screws shall penetrate the wire cloth twice, retaining bar and main frame approximately 4 inches on center.
- D. Provide each screen with two stainless steel spring loaded slide/lock bolts for emergency egress from inside.
- E. Provide each operable screen with aluminum continuous concealed piano hinge 2" open, .060-inch thickness with a 1/8" diameter stainless steel pin, attached to the main frame at the head with square drive TEK screws. Hinge shall be painted with polyester powder coating.
- F. Fully assemble and test each screen at factory.

- G. Configuration: Fabricate a composite screen with a fixed top and a hinged bottom portion to form a wicket to access the operating hardware of the aluminum project-out awning window. Top frame member of the operating portion shall be attached to the bottom frame member of the fixed portion with a full length piano hinge. Provide a latching mechanism for the bottom operating portion of the screen, as approved by the Architect.
- H. Fabricate each screen to integrate with window frame. provide a full size screen for each operating window sash.
- I. Basis of Design Products: Provide Level 4 Aluminum Protector Security Screen Model A-PRO-B for the operating screen and Model A-PRO-Z for the fixed screen portion, manufactured by Kane Architectural Innovations, or equal.

2.4 FINISH

- A. Provide polyester powder coating minimum 2.5 mils thick, meeting or exceeding AAMA 2603 for main frame, concealment plate and screen fabric, in colors selected by Architect, and to match windows.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect opening before beginning installation. Verify that the opening size is correct, fits allowable tolerances, is plumb, level, and conforms to the following:
- B. Provide a solid anchoring surface and comply with approved shop drawings.

3.2 INSTALLATION

- A. Set security screen units plumb, level, and true to line without distortion. Provide adequate support, securely fasten to and align with openings.
- B. Fasten security screen in a manner that will allow expansion and contraction without damage to window members or pullout of fasteners.
- C. Provide anchorage devices and fasteners for securing screens to in-place construction.
- D. Fit units accurately with uniform reveals and spaces.
- E. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- F. Plumb and align faces in a single plane and erect screens square and true, adequately anchored.

3.3 ADJUSTING

- A. Adjust inserts, screens, and hardware to provide a tight fit at contact points for smooth operation and closure.

3.4 CLEANING AND PROTECTION

- A. Clean metal surfaces of security screens promptly after installing exercising care to avoid damaging finishes of new and existing surfaces. Lubricate hardware and other moving parts.
- B. Initiate and maintain protection and other precautions required through the remainder of the construction period to ensure that, except for normal weathering, the units will be free of damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 5656

SECTION 08 7100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Commercial door hardware for the following:
 - a. Swinging doors.
 - 2. Cylinders for doors specified in other Sections.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 08 Section "Hollow Metal Doors and Frames" for factory prefitting and factory premachining of doors for door hardware.
 - 2. Division 08 Section "Flush Wood Doors" for factory prefitting and factory premachining of doors for door hardware.
 - 3. Division 08 Sections "Aluminum-Framed Entrances and Storefronts" for factory prefitting and premachining of doors for door hardware and installation of hardware specified in this section.
 - 4. Division 08 Section "Automatic Door Operators" for door openers/closers for accessible entrances.

1.2 SUBMITTALS

- A. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- B. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
 - a. Type, style, function, size, and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - e. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for hardware.
 - g. Door and frame sizes and materials.
 - h. Keying information.
 - i. Access control equipment and hardware provided by Campus.

2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
3. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.3 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced Door and hardware Institute, Architectural Hardware Consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation and who shall review the schedule for overall coordination of hardware.
 1. Require supplier to meet with Owner to finalize functions of locking devices, keying requirements and to obtain final instructions in writing.
 2. Hardware schedule shall be prepared and sealed by AHC.
- C. Regulatory Requirements: Comply with provisions of the following:
 1. Comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," and ANSI A117.1-2010 , as follows:
 - a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
 - b. Door Closers: Comply with the following maximum opening-force requirements indicated:
 - 1) Interior Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - 2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - c. Thresholds: Not more than ½ inch (13 mm high). Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:

- a. Latches, Locks, and Exit Devices: Not more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
 - b. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
 - c. Thresholds: Not more than 1/2 inch (13 mm) high.
- D. Fire-Rated Doors and Emergency-Exit Openings: Provide door operators that comply with NFPA 80 requirements for doors as emergency exits and that do not interfere with fire ratings.
- E. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by UL, Warnock Hersey, FM, or other testing and inspecting organization acceptable to authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels.
- F. Function and Keying, and Access Control Hardware Conference: Conduct conference at Project site with Campus Hardware and Access Control personnel to comply with requirements in Division 01 Section "Project Management and Coordination." Incorporate function and keying conference decisions, and campus provide access control hardware and accessories into final hardware and keying schedule after reviewing door hardware functions and keying system and access control requirements including, but not limited to, the following:
- 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2. Preliminary key system schematic diagram.
 - 3. Address for delivery of keys.
 - 4. Access control hardware and accessories provided by Campus.

1.4 PRODUCT HANDLING

- A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

- D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).
- E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.5 PROJECT CONDITIONS

- A. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
 - 1. Coordinate with College Access Control department for access control hardware requirements, including electric strikes, card readers and mag locks, that are furnished and installed by the College. Prep doors for the hardware that the College provides.
 - 2. Refer to Access Control Drawings and Electrical Drawings for additional information regarding electrified hardware; coordinate with work indicated on those drawings.
- B. Upon request, check the Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.
- C. Special Project Meeting: Prior to installation of hardware, manufacturers' representatives along with the project architect shall arrange and hold a jobsite meeting to instruct the installing contractors personnel on the proper installation of their respective products. Seminar shall be attended by installers of hardware (including electrical hardware) for aluminum and hollow metal doors. Training will include the use of installation manuals, hardware schedule, templates and physical product samples.

1.6 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of operators and door hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period: From date of Substantial Completion, unless otherwise indicated.:

1. Closers: Ten (10) years.
2. Locksets: Three (3) years
3. Exit Devices: Three (3) years
4. All other Hardware: Two (2) years.

1.7 MAINTENANCE

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide products and manufacturers as listed in "Schedule of Acceptable Manufacturers and Products" included at end of this section.

2.2 SCHEDULED HARDWARE

- A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following:
1. Manufacturer's Product Designations: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated, or equivalent product.

2.3 MATERIALS AND FABRICATION

- A. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated..
1. Provide stainless steel fasteners for thresholds.
- B. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
- C. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed

fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

1. Thru-bolting of hardware will only be permitted where required by NFPA 80, door assembly listing requirements, and the door assembly manufacturer's installation instructions. Fasteners for closer, exit devices and similar hardware that are exposed on opposite face of door from unit will not be permitted.

2.4 HINGES, BUTTS

- A. Templates: Provide only template-produced units for hinges at new frames. Provide units to match existing frame mortises where frame is being re-used.
- B. Screws: Provide Phillips flat-head screws complying with the following requirements:
 1. For metal doors and frames install machine screws into drilled and tapped holes.
 2. For wood doors and frames install wood screws.
 3. For fire-rated wood doors install #12 x 1-1/4-inch, threaded-to-the-head steel wood screws.
 4. Finish screw heads to match surface of hinges.
- C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 1. Out-Swing Exterior Doors: Nonremovable pins.
 2. Out-Swing Corridor Doors: Nonremovable pins.
 3. Interior Doors: Nonrising pins.
 4. Tips: Flat button and matching plug, finished to match leaves.

2.5 CONTINUOUS HINGES

- A. Continuous Hinges: Heavy-duty anodized aluminum non-handed pinless hinge assembly of three interlocking extrusions applied to full height of door and frame without mortising. Provide units with door leaf and jamb leaf geared together for the entire length of the hinge and joined by a channel. Provide hinge knuckle with monolithic appearance. Vertical door loads shall be carried on minimum 3/4 inch acetal bearings through a full 180 degrees.

2.6 LOCK CYLINDERS, CORES AND KEYING

- A. Keying System: Provide keying system as selected by Owner; coordinate with Owner's requirements.
- B. Equip locks with cylinders for interchangeable-core 7-pin tumbler inserts. Furnish only temporary inserts for the construction period, and remove these when directed.
 1. Furnish final cores and keys for installation by Owner.

- C. Comply with Owner's instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.
 - 1. Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."
 - 2. Design master key system allowing for 300 percent expansion.
- D. Metals: Construct lock cylinder and core parts from brass or bronze, stainless steel, or nickel silver.
- E. Key Material: Provide keys of nickel silver only.
- F. Key Quantity: Furnish 10 construction master keys, and 2 construction control keys.

2.7 LOCKS, LATCHES AND BOLTS

- A. Locksets and Latchsets: Provide heavy-duty cylindrical locksets or mortised locksets as scheduled.
 - 1. Lever Trim: As scheduled.
- B. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.
 - 1. Provide flat lip strikes for locks with 3-piece, antifriction latchbolts as recommended by manufacturer.
 - 2. Provide recess type top strikes for bolts locking into head frames, unless otherwise indicated.
 - 3. Provide dust-proof strikes for foot bolts, except where special threshold construction provides nonrecessed strike for bolt.
 - 4. Provide roller type strikes where recommended by manufacturer of the latch and lock units.
- C. Lock Throw: Provide 5/8-inch minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.
 - 1. Provide 1/2-inch minimum throw of latch for other bored and preassembled types of locks and 3/4-inch minimum throw of latch for mortise locks. Provide 1-inch minimum throw for all dead bolts.
- D. Flush Bolt Heads: Minimum of 1/2-inch-diameter rods of brass, bronze, or stainless steel with minimum 12-inch-long rod for doors up to 7'-0" in height. Provide longer rods as necessary for doors exceeding 7'-0" in height.

2.8 EXIT DEVICES

- A. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- B. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
- C. Outside Trim: Lever type of material and finish to match locksets, unless otherwise indicated. Match design for locksets and latchsets.
- D. Through Bolts: DO NOT through bolt exit devices and trim on doors. Prepare doors with reinforcing and blocking to receive hardware.

2.9 PUSH/PULL UNITS

- A. Exposed Fasteners: Provide manufacturer's standard exposed fasteners for installation, thru-bolted for matched pairs but not for single units.
- B. Concealed Fasteners: Provide manufacturer's special concealed fastener system for installation, thru-bolted for matched pairs but not for single units.

2.10 CLOSERS AND DOOR CONTROL DEVICES

- A. Size of Units: Except as otherwise specifically indicated, provide non-sized closers for all units.
- B. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ADA provisions for door opening force and delayed action closing.
- C. Piston: Minimum 1-1/2" diameter one piece steel.
- D. Provide all parallel arm closers with one piece forged extra duty arms or 3/8-inch (9 mm) thick stamped solid steel main and one piece forged or 5/16-inch (8 mm) thick stamped solid steel forearm with bronze bushings.
 - 1. Provide spring cushion arms at all exterior doors, and where indicated.
 - 2. Provide standard stop arms at all parallel arm closers scheduled for interior doors where a wall or floor stop is not feasible, and where indicated.
 - 3. Provide only handed closers.
 - 4. Provide only heavy-duty closers recommended by manufacturer for instructional applications. Standard weight products are not acceptable.
- E. Provide all regular arm closers with forged or stamped steel mainarm.

- F. Provide heavy-duty steel stud shoulder bolts (including main arm and forearm connection) at all regular arm, hold open arm, built-in stop arm, and hold open / built-in stop closers.
- G. Provide exterior closers with all weather hydraulic fluid, suitable from 120°F to -35°F without adjustment.
- H. Provide closers with powder coat finish on body, arm and plate adapter, or corrosion inhibitor primer and sprayed finish coat.
- I. Provide grey resilient parts for exposed bumpers.
- J. Combination Door Closers and Holders: Provide units designed to hold door in open position under normal usage and to release and close door automatically under fire conditions. Incorporate an integral electromagnetic holder mechanism designed for use with UL listed fire detectors, provided with normally closed switching contacts.
 - 1. Provide integral smoke detector device in combination door closers and holders complying with UL 228.

2.11 ELECTRIC STRIKES, MONITOR SWITCHES (DOOR CONTACTS), CARD READERS, MAGNETIC HOLDERS

- A. Description: Provided by Owner.

2.12 DOOR TRIM UNITS

- A. Fabricate protection plates the width of single leaf doors less 1-1/2-inches, and width of door leaf less 1" for pairs of doors, to yield a uniform reveal. Provide on push side by height indicated.
 - 1. Metal Plates: Stainless Steel , 0.050 inch (U.S. 18 gage).

2.13 SMOKE SEALS

- A. General: Provide continuous smoke seals on doors where indicated or scheduled.
- B. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled, based on testing according to UL 1784.
- C. Fire-Labeled Gasketing: Assemblies complying with NFPA 80-1999 that are listed and labeled, based on testing according to UL 10B or NFPA 252.

2.14 WEATHERSTRIPPING AND SEALS

- A. General: Provide continuous weatherstripping on exterior doors and interior doors where indicated or scheduled. Provide noncorrosive fasteners.

- B. Weatherstripping at Jambs and Heads: Provide brush type insert and extruded aluminum with anodized finish retainer strips, surface applied, of design and size scheduled.
- C. Weatherstripping Sweep: Provide sweep consisting of brush type insert and extruded aluminum with anodized finish housing, surface applied, of design and size scheduled.

2.15 THRESHOLDS

- A. General: Except as otherwise indicated, provide standard metal threshold unit of type, size, and profile as shown or scheduled.
- B. Thresholds: Not more than ½ inch (13 mm high). Bevel raised thresholds with a slope of not more than 1:2.

2.16 HARDWARE FINISHES

- A. Provide satin chrome, BHMA 626 (US26D) finish for all hardware items to greatest extent possible or manufacturer's standard finish matching this finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame supports, and other conditions affecting performance of door hardware.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
 - 1. All doors with lever trim shall have hardware mounted at heights required by ADA (Americans with Disabilities Act) regulations.
 - 2. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
 - 3. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work

specified in the Division 09 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

- C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Pre-drill and countersink doors, frames and units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Hand tighten screws and fasteners, use of power driven tools must be limited to preliminary driving screws if permitted by door and hardware manufacturer.
- F. Replace doors damaged by improper hardware installation.
- G. Set thresholds for exterior doors in full bed of sealant specified in Division 07 Section "Joint Sealant."
- H. Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.3 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
 - 1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- B. Adjust door closers in accordance with manufacturer's instructions for proper door closer adjustment for spring power, backcheck, closing and latching speed.
- C. Clean adjacent surfaces soiled by hardware installation.
- D. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.
- E. Six-Month Adjustment: Approximately six months after the date of Substantial Completion, the Installer, accompanied by representatives of the manufacturers of latchsets and locksets and of door control devices, and of other major hardware suppliers, shall return to the Project to perform the following work:

1. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.
2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
3. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.
4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE SCHEDULE

- A. **SCHEDULE OF ACCEPTABLE MANUFACTURERS AND PRODUCTS:** Manufacturers and products are listed to establish the general product appearance, type and quality intended for use, and Owner preference for the Project. Certain items have been specially selected for their appearance and function, and to match existing campus standard hardware. Equal products of manufacturers other than those listed below may be acceptable where "or equal" is indicated, subject to the approval of the Architect. Substitutions proposed for hardware items must be equivalent in every way, as judged solely by Architect
- B. The following list indicates the Owner's standard manufacturers for provision of type of hardware listed, unless equivalent products or manufacturers are specified. Refer to the Hardware Sets for the scheduled products required per door opening.
1. Hinges: Hager BB 1279, full mortise standard weight, BHMA 652 (US26D) finish; 4-1/2" x 4-1/2", 2-ball bearing 5-knuckle; or equivalent by Bommer, McKinney. or Stanley.
 2. Continuous Hinges: Roton Model 780-224 for 1-3/4" thick doors and 780-226HD for 2" thick doors; Campus Standard - No Substitutions
 3. Electric Strikes: By Campus Access Control.
 4. Locksets/Latchsets: Best 93K Series with lever style 14 and rose style D, with interchangeable/ removable core. Campus Standard - No Substitutions
 - a. Dormitory Lockset: 9K37T14DS3626F90
 - b. Passage Lockset: 9K30N1SDS3626F75
 - c. Privacy Lockset: 9K30L1SDS3626F76
 - d. Storeroom Lockset: 9K37D14DS3626F86
 5. Electromechanical Lock: By Campus Access Control.
 6. REX (request to exit button) - by Campus
 7. Magnetic Door Holder: By Campus Access Control.
 8. Door Contacts: By Campus Access Control.
 9. Interchangeable Cores: Match existing keying system, for insertion in locksets, exit devices, and elsewhere as scheduled; finish to match lockset. Provide with key and concealed cylinder stamping.
 10. Cylinders for use with Interchangeable Core: Match existing campus keying system, no substitutions. Medeco keyway, 7-pin, with temporary construction cores, finish to match lockset. Provide Construction cores for all cylinders at exit devices as well

11. Closers: Provide parallel or standard arm closers as indicated in the General Notes below; reduced opening force for handicapped; in aluminum powder painted finish BHMA 689; Norton 7500 series, with full metal covers. Campus Standard - No Substitutions
12. Exit Devices: Von Duprin 99 Series, 996L trim as scheduled, with lever trim to match locksets, less cylinders, BHMA 626 finish, cylinder dogging feature at non-fire exit devices. Campus Standard - No Substitutions
13. Coordinator: Rockwood 1600 Series, with mounting brackets, as required 576 series at doors with overhead stops, or where 1600 is not feasible; or equivalent by Ives.
14. Kickplates: Ives No. 8400 LDW, stainless steel, 10-inches high unless otherwise indicated, by door width, where indicated, or approved equivalent by Rockwood.
15. Push Plate: Rockwood, 71RC stainless steel, BHMA 630 finish; or equivalent by Ives.
16. Pull: Rockwood, No. 111, 11 inches, stainless steel, BHMA 630 finish; or equivalent by Ives.
17. Peep Holes: Parker Hardware, Model #05334, or equal.
18. Silencers: Ives SR-64 for hollow metal frames, or equivalent by Rockwood.
19. Wall Stops: Rockwood No. 406, 407 or 408 as required by wall material, with grey bumper and BHMA 630 finish; or equivalent by Ives
20. Floor Stops: Rockwood No. 441 or 443 as required, provide risers 449 as required, with grey bumper and BHMA 630 finish; or equivalent by Ives.
21. Overhead Stops: Rockwood OH 1000 Series stainless steel, of size required, or equivalent by Ives.
22. Flush Bolts: McKinney FB Series, or equal by Rockwood or Trimco
23. Smoke Seal: Pemko S-88, or equivalent.

C. SCHEDULED HARDWARE SETS

GENERAL NOTES:

1. Doors hardware shall not prohibit exiting from spaces.
2. Provide hardware finishes above unless noted otherwise for a specific set or door.
3. Provide all required installation accessories and options necessary for complete installation of each hardware component, to ensure proper operation of the product.
4. Coordinate all hardware components for each door leaf for overall compatibility.
5. Through-bolting of hardware is not permitted, coordinate all blocking requirements with door manufacturer.
6. Provide all interior doors with wall stops, one per leaf; provide overhead type as required when wall stop not feasible. Specific stops scheduled are exceptions to this.
7. Provide 3 silencers per single door and 2 silencers per pair doors except omit on weatherstripped and smoke and sound sealed doors.
8. Where door closers are scheduled below, provide parallel or standard arm closers placed on the least conspicuous side of the door, unless noted otherwise.
9. Provide cylinders with final cores for access doors as required; coordinate with applicable specification section.

10. Provide specified smoke seal at perimeter for all rated openings on corridor walls and at all smoke control doors where smoke compartments are indicated on drawings. In addition, provide specified smoke astragal seal at all pairs of doors at rated openings on corridor walls as required by door manufacturer to meet smoke sealing requirements.
11. Furnish hardware for aluminum doors (field apply closer) to manufacturer's plant for installation
12. Functions: The lockset/exit device function specified is for BIDDING ONLY. Review all lock and exit device functions with Owner prior to submission of door schedule.
13. The Door Schedule specifies some products for aluminum doors in this Section to ensure one manufacturer of exit devices, locksets, and closers throughout the Project. These items must match throughout the building regardless of who supplies them.

D. HARDWARE SETS

SET #1 - PAIR EXTERIOR DOORS (Doors 0-100A and 0-100C)

2	Continuous hinges
1	Removable mullion (keyed)
2	Rim exit device CD 99L-NL-996NL (nightlatch with cylinder dogging, lever trim, key retracts latchbolt)
1	Automatic operators (full opening of pair) with 2 push pad activators; right leaf is the automatic operator door
1	Threshold
1	Set perimeter and meeting stile weatherstripping
2	Sweep weatherstripping
1	Card reader - by Campus
2	Mag locks - by Campus
2	REX (request to exit button) - by Campus
2	Door contacts - by Campus
1	Aluminum guard rail/remote post combination (Door 0-100C only)

SET #2 - PAIR INTERIOR DOORS (Doors 0-100B and 0-100D)

2	Continuous hinges
2	Push bars
2	Pull bars
1	Automatic operators (full opening of pair) with 2 push pad activators; right leaf is the automatic operator door

SET #3 - SINGLE INTERIOR DOOR (Door 0-102, 1-101, 1-104, 1-105, 1-111, 1-112, 1-201, 1-204, 1-205, 1-211, 1-212, 1-301, 1-304, 1-305, 1-311, 1-312, 1-401, 1-404, 1-405, 1-411, 1-

412, 2-101, 2-104, 2-105, 2-111, 2-112D.1, 2-201, 2-204, 2-205, 2-211, 2-212, 2-301, 2-304, 2-305, 2-311, 2-312, 2-401, 2-404, 2-405, 2-411, 2-412)

3	Hinges
1	Lockset, storeroom function
1	Closer
1	Kickplate

SET #4 - SINGLE INTERIOR DOOR (Door 0-104, 0-106, 0-108)

3	Hinges
1	Lockset, privacy function
1	Closer

SET #5 - SINGLE INTERIOR DOOR (Door 0-107, 0-110)

3	Hinges
1	Lockset, office function
1	Automatic operator (fire-rated) with push pad activators (2)
1	Electric strike - by Campus

SET #6 - SINGLE INTERIOR DOOR (Door 0-103, 0-105)

3	Hinges
1	Lockset, office function
1	Closer

SET #7 - SINGLE INTERIOR DOOR (Door 1-103, 1-107, 1-203, 1-207, 1-303, 1-307, 1-403, 1-407, 2-103, 2-107, 2-113, 2-203, 2-207, 2-303, 2-307, 2-403, 2-407)

3	Hinges
1	Lockset, dormitory function
1	Automatic operator (fire-rated) with remote (hand-held) activator
1	Electric strike - by Campus
1	Door viewer

SET #8 - SINGLE INTERIOR DOOR (Door 1-102, 1-106, 1-109, 1-113, 1-114, 1-202, 1-206, 1-209, 1-213, 1-214, 1-302, 1-306, 1-309, 1-313, 1-314, 1-402, 1-406, 1-409, 1-413, 1-414, 2-102, 2-106, 2-109, 2-202, 2-206, 2-209, 2-213, 2-214, 2-302, 2-306, 2-309, 2-313, 2-314, 2-402, 2-406, 2-409, 2-413, 2-414)

3	Hinges
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1	Lockset, dormitory function
1	Closer
1	Door viewer

SET #9 - SINGLE INTERIOR DOOR (Door 1-197, 1-199, 1-297, 1-299, 1-397, 1-399, 1-497, 1-499, 2-197, 2-199, 2-297, 2-299, 2-397, 2-399, 2-497, 2-499)

3	Hinges
1	Rim fire exit device 99L-BE-F-996L (lever, blank escutcheon, always operable, no cylinder)
1	Closer

SET #10 - SINGLE EXTERIOR DOOR (Door 1-197A, 2-197A, 2-199A)

3	Hinges
1	Rim fire exit device 99L-DT-F-996L (lever, dummy trim)
1	Closer
1	Threshold
1	Set perimeter weatherstripping
2	Sweep weatherstripping
1	Electric strike - by Campus
1	Card reader - by Campus
1	Mag lock - by Campus
1	REX (request to exit button) - by Campus
1	Door contact - by Campus

SET #11 - PAIR EXTERIOR DOORS (Doors 2-112A, 2-112B, 2-112C, 2-112D)

6	Hinges
1	Removable mullion (keyed)
2	Rim exit device CD 99L-NL-996NL (nightlatch with cylinder dogging, lever trim, key retracts latchbolt)
2	Closers
2	Kickplates
1	Threshold
1	Perimeter weatherstripping
1	Sweep
1	Card reader - by Campus
2	Mag locks - by Campus
2	REX (request to exit button) - by Campus
2	Door contacts - by Campus

SET #12 - SINGLE EXTERIOR DOOR (Door 1-113A, 199-A)

3	Hinges
1	Lockset, entrance function
1	Closer
1	Threshold
1	Set perimeter weatherstripping
2	Sweep weatherstripping

SET #13 - PAIR INTERIOR DOORS (Doors 0-111)

6	Hinges
1	Lockset, passage function, active leaf
1	Automatic flush bolts, inactive leaf
2	Closers
1	Coordinator
2	Kickplates
1	Mag lock - by Campus
1	REX (request to exit button) - by Campus
1	Card reader - by Campus

SET #14 - SINGLE INTERIOR DOOR (Door E and F in non-accessible dorm room and Door E in non-accessible apartment)

3	Hinges
1	Lockset, privacy function

SET #15 - SINGLE INTERIOR DOOR (Door A, B and C in non-accessible dorm room and Door G and I in non-accessible apartment)

3	Hinges
1	Lockset, entrance function

SET #16 - SINGLE INTERIOR DOOR (Door G and I in accessible apartment, Doors A, B, and C in accessible dorm room)

3	Hinges
1	Lockset, entrance function
1	Automatic operator with remote (hand held) activator
1	Electric strike (by Campus)

SET #17 - SINGLE INTERIOR DOOR (Door B, F, H and J in non-accessible apartment, Door B, D, H and J in accessible apartment)

3	Hinges
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1 Lockset, passage function

SET #18 - SINGLE INTERIOR DOOR (Door C in accessible apartment, Doors E and F in accessible dorm rooms)

3 Hinges
1 Lockset, privacy function
1 Automatic operator with remote (hand held) activator
1 Electric strike (by Campus)

SET #19 - SINGLE INTERIOR DOOR (Door 1-108, 1-208, 1-308, 1-408, 2-108, 2-208, 2-308, 2-408)

3 Hinges
1 Lockset, passage function
1 Automatic operator (fire-rated) with push pad activators
1 Electric strike - by Campus

SET #20 - SINGLE INTERIOR DOOR (Door 1-110, 1-210, 1-310, 1-410, 2-110, 2-210, 2-310, 2-410)

3 Hinges
1 Lockset, passage function
1 Closer
1 Magnetic door holder (tied into fire and smoke detection system) - by Campus

SET #21 - SINGLE INTERIOR DOOR (Door 0-102A, 1-105, 1-112A, 1-205, 1-212A, 1-305, 1-312A, 1-405, 1-412A, 2-105, 2-112A, 2-112E, 2-205, 2-212A, 2-305, 2-312A, 2-405, 2-412A)

3 Hinges
1 Lockset, storeroom function
1 Closer
1 Kickplate
1 Card reader - by Campus
1 Electric strike - by Campus

SET #22 - SINGLE EXTERIOR DOOR (Door 2-113A)

3 Hinges
1 Lockset, entrance function
1 Automatic operator with remote (hand-held) activator

- 1 Threshold
- 1 Set perimeter weatherstripping
- 2 Sweep weatherstripping
- 1 Electric strike (by Campus)

END OF SECTION 08 7100

SECTION 087113 - AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Low-energy automatic door operators for interior swinging single doors, with visible header mounting.
 - a. Provide fire door package with UL listed equipment for all fire-rated doors.
2. Low-energy automatic door operators for interior and exterior swinging pairs of doors, with visible header mounting, and with operation as follows:
 - a. Automatic operator opens one leaf in each pair, with operator enclosure spanning full width of door pair.
 - b. Interior and exterior door leafs shall operate independently of each other.
3. Actuators and safety devices for automatic door operators.
4. Guide rail for door actuators.

B. Related Work Specified Elsewhere:

1. Division 26 Sections for electrical connections provided separately including conduit and wiring for power to, and control of, automatic door operators

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic door operators, including activation and safety devices and bollards. Include operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For automatic door operators and related components. Include plans, elevations, sections, details, and attachments to other work.
 1. Indicate required clearances, method of field assembly, components, and location and size of each field connection.
 2. Include locations and elevations of entrances showing activation and safety devices.
 3. Wiring Diagrams: For power, signal, and activation- and safety-device and bollards wiring.
 4. Include plans, elevations, sections, and attachment details for guide rails
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and certified inspector.
- B. Field quality-control reports.
- C. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For automatic door operators, including activation and safety devices, to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project and who employs a certified inspector.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
- B. Certified Inspector Qualifications: Certified by the AAADM.
- C. Source Limitations: Obtain automatic door operators, including activation and safety devices, from single source from single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.
- E. Exit-Door Requirements: Comply with requirements of authorities having jurisdiction for doors with automatic door operators serving as a component of a required means of egress.
- F. Fire Rated Door Requirements: Automatic operators shall be UL 10C "Positive Pressure Fire Tests of Door Assemblies" listed.
- G. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of door frames by field measurements before fabrication of exposed covers for automatic door operators.
- B. Adjust and modify existing doors and frames to receive automatic operators as required for complete installation.

1.7 COORDINATION

- A. Templates: Obtain and distribute, to the parties involved, templates for doors, frames, operators, and other work specified to be factory prepared and reinforced for installing automatic door operators. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.
 - 1. Coordinate installation of anchorages for bollards and actuators. 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.
- B. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators, including activation and safety devices, with connections to power supplies and to access-control system.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty or sporadic operation of automatic door operator, including activation and safety devices.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
 - 2. Warranty Period: One year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of automatic door operator Installer. Include quarterly planned and preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.
 - 1. Engage a certified inspector to perform safety inspection after each adjustment or repair, and at end of maintenance period. Furnish completed inspection reports to Owner.
 - 2. Perform maintenance, including emergency callback service, during normal working hours.
 - 3. Include 24-hour-per-day, seven-day-per-week emergency callback service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Product: Provide M-Force Operator with Swing-Guard LE door mounted safety system manufactured by Stanley Access Technologies; Division of The Stanley Works.
 - 1. Other Acceptable Manufacturers:
 - a. DORMA
 - b. NABCO Entrances, Inc.
 - c. Norton

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with standards indicated below:
 - 1. Sheet: ASTM B 209 (ASTM B 209M).
 - 2. Extrusions: ASTM B 221 (ASTM B 221M).
- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.3 AUTOMATIC DOOR OPERATORS, GENERAL

- A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated; and complying with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.
 - 1. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load as indicated on Structural Drawings.
- B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation-and safety-device wiring, and manual operation including spring closing when power is off.
- C. Door Arms: A combination of door arms and linkage shall provide positive control of door through entire swing; units shall permit use of butt hung, center pivot, and offset pivot-hung doors.

- D. Housing for Overhead Concealed Operators: Fabricated from minimum 0.125-inch-thick, extruded or formed aluminum and extending full width of door opening including door jambs to conceal door operators and controls. Housing shall not exceed 6" square in section and shall have structurally integrated end caps. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
- E. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.
- F. Fire-Door Package: Consisting of UL-listed latch mechanism, power-reset box, and caution signage for fire-rated doors. Latch mechanism shall allow door to swing free during automatic operation; when fire is detected, latch actuator shall cause exit hardware to latch when door closes. Provide latch actuators with fail-secure design.
- G. 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.

2.4 LOW-ENERGY DOOR OPERATORS

- A. Standard: BHMA A156.19.
- B. Performance Requirements:
 - 1. Opening-Force Requirements for Egress Doors: In the event power failure to the operator, swinging automatic entrance doors shall open with a manual force, not to exceed 30 lbf (133 N) to set door in motion, and not more than 15 lbf to fully open the door. Forces shall be applied at 1" (25 mm) from the latch edge of the door.
 - 2. Capacity: Rated for door panels weighing up to 700 lb (318 kg).
 - 3. Consistent Cycle: The operator shall deliver an even, consistent open manual push force across the entire transition from door fully closed to door fully open. Additionally, the force shall be field adjustable to accommodate a wide range of on-site conditions.
 - 4. Quiet Performance: The operator shall be designed to output audible noise ratios less than or equal to 50dba.
 - 5. Field Adjustable Open Stop: The operator shall provide a field adjustable open stop to accommodate opening angles from 80 to 135 degrees without the need for additional components.
 - 6. Operating Range: Minus 30 deg F to 130 deg F.
- C. Configuration: Operator to control pair of swinging door.
 - 1. Traffic Pattern: Two way.
 - 2. Operator Mounting: Overhead visible.

- D. Operation: Power opening and field-adjustable spring closing operation. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.
- E. Power Requirements: 120VAC, 5 amps, 50/60 Hz.
- F. Electrical Control System: Electrical control system shall include a microprocessor controller and a high-resolution position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed. Electrical control system shall include a 24 VDC auxiliary output rated at 1 amp.
- G. Features:
 - 1. Adjustable opening and closing speed.
 - 2. Adjustable opening and closing force.
 - 3. Adjustable backcheck.
 - 4. Adjustable hold-open time from zero to 30 seconds.
 - 5. Reverse on obstruction
 - 6. Time delay for electric lock integration.
 - 7. Force compensation and closed loop speed control with active braking and acceleration.
 - 8. Power Close.
 - 9. Slam Protection.
 - 10. Power Assist.
 - 11. Lock Release.
 - 12. Stall Sensor Ignore.
 - 13. Electronic Coordination.
 - 14. Switch to open/Switch to close operation.
 - 15. Push to activate operation.
 - 16. Fire alarm interface, configurable to safely open or close doors on signal from fire alarm system.
- H. Exposed Finish: Clear anodized finish.

2.5 ACTIVATION AND SAFETY DEVICES

- A. General: Provide activation and safety devices in accordance with BHMA standards, for condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.
- B. Single Push Plates: Provide 4-1/2 inch square push plates with UL recognized SPDT switch. Face plates and mounting studs shall be stainless steel. Face plates shall be engraved with the international symbol for accessibility and "Push To Open".

1. Interior push plates shall be flush mounted in wall or mounted on metal bollard as indicated, and hardwired to door operator controls.
 2. Exterior push plates shall be surface mounted to wall or mounted on metal bollard as indicated, and hardwired to door operator controls.
 3. Basis of Design Product: Provide BEA Inc. Model 10PBS451 or equal.
- C. Wireless or Remote Radio-Control Switch: Radio-control system consisting of header-mounted receiver and handheld, battery-operated transmitter switch.
- D. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.
- E. Door Mounted Presence Detection Sensors: Door mounted overhead presence detection sensors shall be reflective active infrared type designed specifically to sense moving or stationary objects in the push side swing zone of a moving door leaf. Sensor housings shall be high impact shock resistant with tinted lenses suitable for door mounting. Door mounted presence detection sensors shall not be affected by ultrasonic, ambient light or radio frequencies, within the vicinity of the swing door. Supporting relays and controllers shall be provided for a complete working system
1. Presence detection sensors shall provide the following modes of operation:
 - a. Always enabled for both manual and knowing act activation.
 - b. Only enabled after push plate activation.
 - c. Enabled when door reaches full open position with manual use.
 2. Basis of Design Product: Provide Stanley Access Technologies Swing-Guard LE or equal.

2.6 METAL GUIDE RAILS AND REMOTE POST FOR DOOR ACTUATORS

- A. Guide Rail and Remote Post Assembly: Guide rail/remote post assembly combination fabricated from aluminum extrusions to mount door activation devices and provide a means to efficiently and aesthetically route wires. Card readers can be added to the remote post below a wall switch, and wires can be routed to door jambs or operators through the guide rails. Provide floor to wall guide rail with vertical support combined with remote post assembly.
1. Guide Rail: 1-1/2" x 1/2" 6063-T5 anodized aluminum extrusion.
 2. Remote Posts: 4" X 6" X 40" with 3/16" wall.
 3. Length: As indicated on Drawings.
 4. Style: Top and bottom horizontal rails and intermediate horizontal rail
 5. Basis of Design Product: Aluminum Guide Rail/Remote Post Combination by Larco, or equal.
 6. Finish: Clear Anodized Aluminum

2.7 FABRICATION

- A. Factory fabricate automatic door operators to comply with indicated standards.
- B. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within operator enclosure to the exterior.
- C. Form aluminum shapes before finishing.
- D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.
- E. Provide metal cladding, completely cladding visible surfaces before shipment to Project site. Fabricate cladding with concealed fasteners and connection devices, with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors.

2.8 ACCESSORIES

- A. Signage: As required by ANSI/BHMA A156.19 standard for the type of operator.
 - 1. Application Process: Door manufacturer's standard process.
 - 2. Provide sign materials with instructions for field application when operators are installed.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- E. Class I, Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.40 mils or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of automatic door operators.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation, including activation devices.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install complete automatic door operators according to manufacturer's written instructions, including activation and safety devices, control wiring, and remote power units if any; connection to the building's power supply; and signage.
 - 1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
 - 2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.
 - 3. Low-Energy Door Operator Installation Standard: BHMA A156.19.
- B. Power Connection: See Division 26 Sections for connection to electrical power distribution system.
- C. Activation and Safety Devices: Install devices and wiring according to manufacturer's written instructions and cited BHMA standard for type of operator and direction of pedestrian travel. Connect activation- and safety-device wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- D. Guide Rails with Remote Post: Surface mount to sidewalk and building walls with mounting flange/mounting base in accordance with manufacturer's directions.
- E. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

3.3 FIELD QUALITY CONTROL

- A. Inspection: Engage Installer's certified inspector to test and inspect automatic door operators and prepare test and inspection reports.
 - 1. Certified inspector shall test and inspect each automatic door operator to determine compliance of installed systems with applicable BHMA standards.
 - 2. Inspection Report: Certified inspector shall submit report in writing to Architect and Contractor within 24 hours after inspection.
- B. Work will be considered defective if it does not pass tests and inspections.

3.4 ADJUSTING

- A. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 - 1. Adjust operators on exterior doors for weathertight closure.
- B. After completing installation of exposed, factory-finished automatic door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.
- C. Readjust automatic door operators after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).
- D. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 DEMONSTRATION

- A. Engage a certified inspector to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators.

END OF SECTION 087113

SECTION 08 8000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
1. Windows.
 2. Doors.
 3. Interior borrowed lites, sidelights and transoms.
 4. Glazed entrances.
 5. Curtainwall framing.
 6. Storefront framing.
 7. Interior glazed partitions.
 8. Mirrors (unframed).

1.2 DEFINITIONS

- A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.
- B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- C. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- D. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for 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.
- E. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Where glass thicknesses are indicated these are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Where glass thickness is not indicated design glass thickness and types of glass required by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
 - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
 - a. Wind Loads: Provide glazing capable of resisting wind positive and negative pressures calculated according to the New York Building Code Section 1609.6 and the following criteria:
 - 1) Basic Wind Speed (3 second gust) = as indicated on Structural Drawings
 - 2) Wind Load Importance Factor I_w = as indicated on Structural Drawings
 - 3) Wind Speed Category = as indicated on Structural Drawings
 - 4) Other applicable criteria indicated on Structural Drawings.
 - b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
 - 1) Load Duration: 60 seconds or less.
 - c. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.
 - 1) For insulating glass.
 - 2) For laminated glass
 - 3) For monolithic-glass lites heat treated to resist wind loads.
 - d. Minimum Glass Thickness for Exterior Lites: Not less than 1/4" (6 mm).
 - e. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.
 - C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6 mm thick, unless otherwise indicated.
 2. For laminated-glass lites, properties are based on products of construction indicated.
 3. For insulating-glass units, properties are based on units with lites 6 mm thick and a nominal 1/2-inch- (13-mm-) wide interspace, unless otherwise indicated.
 4. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
 5. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
 6. Solar Optical Properties: NFRC 300.

1.4 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Submit an Environmental Product Declaration (EPD) from the manufacturer for glass within this specification section, if available. A statement of the contractor's good faith effort to obtain the EPD shall be provided if not available.
1. Manufacturer provided EPDs must be Product Specific Type III (Third Party Reviewed), in adherence with ISO 14025 Environmental labels and declarations, ISO 14044 Environmental management Life cycle assessment, and ISO 21930 Core rules for environmental product declarations of construction products and services.
- C. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass and of 12-inch- (300-mm-) long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
1. Insulating glass for each designation indicated.
 2. Each type of laminated glass specified.
 3. Each type of fire-rated glass specified.
 4. For each color (except black) of exposed glazing sealant indicated.
 5. Spandrel glass.
- D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- D. Product Test Reports: From a qualified testing agency indicating the following products comply with requirements, based on comprehensive testing of current products:
 1. Insulating glass.
 2. Coated float glass.
 3. Glazing sealants.
 4. Fire resistive glazing
- E. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of glass from one primary-glass manufacturer.
- C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer
- D. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
 1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- E. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
- F. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glass type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants.
1. Use manufacturer's standard test methods to determine whether priming and other specific preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - a. Perform tests under normal environmental conditions replicating those that will exist during installation.
 2. Submit not fewer than nine pieces of each type and finish of glass-framing members and each type, class, kind, condition, and form of glass (monolithic, laminated, and insulating units) as well as one sample of each glazing accessory (gaskets, tape sealants, setting blocks, and spacers).
 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.
- G. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 252.
- H. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 257.
- I. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
 2. Safety glass includes fully tempered glass, laminated glass and fire-resistant glass.
- J. Fire-Rated Glass: Permanently mark fire-rated glass with certification label of certification agency acceptable to authorities having jurisdiction indicating manufacturer name, test standard and fire-rating.

- K. Glazing Publications: Comply with published recommendations of glass product 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. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines."
 2. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."
 3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
- L. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:
1. Insulating Glass Certification Council.
 2. Associated Laboratories, Inc.
 3. National Accreditation and Management Institute.
- M. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Manufacturer's Special Warranty on Coated-Glass Products: Written warranty, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for those coated-glass units that deteriorate as defined in "Definitions"

Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

D. Manufacturer's Special Warranty on Laminated Glass: Written warranty, made out to Owner and signed by laminated-glass manufacturer agreeing to furnish replacements for laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Five years from date of Substantial Completion.

E. Manufacturer's Special Warranty on Fire Rated Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 5 years from date of Substantial Completion.

F. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRIMARY FLOAT GLASS

A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); Class 1 unless otherwise indicated in schedules at the end of Part 3.

1. Ultra-Clear (Low-Iron) Float Glass: Class I (clear); with a minimum 91 percent visible light transmission and a minimum solar heat gain coefficient of 0.87.

a. Product: Vitro Architectural Glass; Starphire Ultra-Clear, or equal.

2.2 HEAT-TREATED FLOAT GLASS

A. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

- A. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated in schedules at the end of Part 3.

2.3 COATED FLOAT GLASS

- A. General: Provide coated glass complying with requirements indicated in this Article and in schedules at the end of Part 3.
 - 1. Provide Kind HS (heat-strengthened) coated float glass in place of coated annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.
- B. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified in schedules at the end of Part 3.
 - 1. Basis of Design Product: Solarban 72 by Vitro Architectural Glass or equal by Viracon.
- C. Ceramic-Coated Fritted Glass: ASTM C 1048, Type I, Condition B, Quality-Q3, and complying with other requirements specified.
 - 1. Basis of Design Product: Viraspan by Viracon or equal
 - 2. Color: Gray V908. As scheduled.

2.4 FIRE RATED GLAZING

- A. Fire-Rated Glazing Product (Laminated Ceramic Glazing Material) for Wood and Hollow Metal Doors and Frames: Proprietary Category I and II safety glazing product in the form of 2 lites of clear ceramic glazing material laminated together to produce a laminated lite of 5/16-inch nominal thickness; polished on both surfaces, weighing 4 lb/sq. ft.; and as follows:
 - 1. Fire-Protection Rating: As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Polished on both surfaces, transparent.
 - 3. Product: "FireLite Plus Premium" by Nippon Electric Glass Co., Ltd., and distributed by Technical Glass Products

2.5 LAMINATED GLASS

- A. Laminated Glass: Comply with ASTM C 1172 for kinds of laminated glass indicated and other requirements specified, including those in the Laminated-Glass Schedule at the end of Part 3.

- B. Interlayer: Interlayer material as indicated below, clear or in colors, and of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
 - 1. Interlayer Material: Polyvinyl butyral sheets
 - 2. Interlayer Thickness: .030" except provide .060" thickness for laminating two lites of heat strengthened glass together, and where scheduled.
 - 3. Interlayer Color: Clear.
- C. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets as follows:
 - 1. Laminate lites with polyvinyl butyral interlayer in autoclave with heat plus pressure.

2.6 INSULATING GLASS

- A. Insulating-Glass Units: Preamsembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in the Insulating-Glass Schedule at the end of Part 3.
 - 1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated. Provide heat soaked glass where scheduled.
- B. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule at the end of Part 3 are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
- C. Sealing System: Dual seal, with primary and secondary sealants as follows:
 - 1. Manufacturer's standard sealants.
- D. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
 - 1. Aluminum with black finish for structural silicone glazing applications
 - 2. Aluminum with mill or clear-anodized finish for all other applications.
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both.
 - 4. Corner Construction: Manufacturer's standard corner construction.

2.7 MIRROR GLASS AND ACCESSORIES

- A. Standard Units: Provide 1/4 inch float "silvering" quality glass with electrolytic application of copper to provide first quality distortion free mirrors. Products shall conform to ASTM C 1503-01. Where frameless, all mirror edges shall be ground and

polished to a 45 degree bevel. Apply water-resistant paint to rear side of units prior to setting.

- B. Safety Units: Mirrors for all areas where the bottom edge is within 18 inches of the floor or accessible to human impact shall be provided with a Category II Tape Backing which shall conform to CPSC 16CFR1201 for safety glazing requirements. Provide CRL Shatterproof Safety Tape for Mirrors, Product #2MT24 by CR Laurence, or equal.
- C. Mirror Hardware:
 - 1. Plated Steel Hardware: Formed- stainless steel shaped or steel shapes with chrome plated finish.
 - 2. Profile: As indicated.
- D. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- E. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.
- F. Mirror Mastic - Palmer Products Corp. ("Mirror-Mastic Bond" and "Mirro-Mastic Adhesive"); C. Gunther Company ("Ultra/Bond" and "Extra/Bond") or approved equal. Primer systems shall be type recommended by mirror mastic manufacturer for intended substrates.
- G. Fabricate mirrors in the shop to greatest extent possible. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

2.8 ELASTOMERIC GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 - 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range for this characteristic.
 - 4. Field-applied sealants shall have a VOC content complying with Section 01 8113 "Sustainable Design Requirements."

- B. Single-Component Neutral-Curing Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 50; Uses NT, M, G, A, and, as applicable to joint substrates indicated, O.

1. Products:

- a. Dow Corning Corporation; 791.
- b. Dow Corning Corporation; 795.
- c. GE Silicones; SilPruf NB SCS9000.
- d. GE Silicones; UltraPruf II SCS2900.
- e. Pecora Corporation; 865.
- f. Pecora Corporation; 895.
- g. Pecora Corporation; 898

- C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.9 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

- B. Expanded Cellular Glazing Tape: Closed-cell, PVC foam tape; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.
2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

- C. Glazing Tapes for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.10 GLAZING GASKETS

- A. Glazing gaskets for storefront and entrance systems are specified in Division 08 Section "Aluminum-Framed Storefronts and Entrances", "Fire-Rated Aluminum Storefronts and Entrances" and "All-Glass Storefronts and Entrances".

- B. Glazing gaskets for glazed aluminum curtain wall systems are specified in Division 08 Section "Glazed Aluminum Curtain Walls."

- C. Glazing gaskets for aluminum windows are specified in Division 08 Section "Aluminum Windows."

2.11 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. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Silicone elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating

2.12 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze 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 standard, to comply with system performance requirements.
- B. Grind smooth and polish exposed glass edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing 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. Effective sealing between joints of glass-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 glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 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. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- 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 sealant-substrate 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 the length plus width is larger than 50 inches (1270 mm) as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- 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.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance 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. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 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.

3.7 PROTECTION AND CLEANING

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

3.8 GLASS SCHEDULE

- A. Exterior Glazing:
 - 1. Glazing Type XGL-1: Provide 1-inch low-E coated, clear insulated tempered glass, safety glazing as follows:
 - a. Outboard Lite: 1/4-inch thick clear, low-iron, fully tempered (Kind FT) glass, low-E coated on the second surface.
 - 1) Low-Emissivity Sputter Coating: Solarban 72 by Vitro Architectural Glass.
 - 2) Low-Iron Glass: Starphire Ultra-Clear by Vitro Architectural Glass
 - b. Air Space: 1/2 inch, argon filled.
 - c. Inboard Lite: 1/4-inch thick clear, low-iron fully tempered (Kind FT) glass.

- 1) Low-Iron Glass: Starphire Ultra-Clear by Vitro Architectural Glass
- d. Performance Characteristics:
 - 1) Visible Light Transmittance: Min 68%.
 - 2) Winter Nighttime U-Value: Max. 0.24
 - 3) Solar Heat Gain Coefficient (SHGC): Max. 0.28
 - 4) Outdoor Visible Light Reflectance: 13%
2. Glazing Type XGL-2: Provide 1-inch low-E coated, clear insulated glass, non-safety glazing as follows:
 - a. Outboard Lite: 1/4-inch thick clear, low-iron, heat strengthened (Kind HS) glass, low-E coated on the second surface.
 - 1) Low-Emissivity Sputter Coating: Solarban 72 by Vitro Architectural Glass.
 - 2) Low-Iron Glass: Starphire Ultra-Clear by Vitro Architectural Glass
 - b. Air Space: 1/2 inch, argon filled.
 - c. Inboard Lite: 1/4-inch thick clear, low-iron heat strengthened (Kind HS) glass.
 - 1) Low-Iron Glass: Starphire Ultra-Clear by Vitro Architectural Glass
 - d. Performance Characteristics:
 - 1) Visible Light Transmittance: Min 68%.
 - 2) Winter Nighttime U-Value: Max. 0.24
 - 3) Solar Heat Gain Coefficient (SHGC): Max. 0.28
 - 4) Outdoor Visible Light Reflectance: 13%
3. Glazing Type XGL-3: Provide 1 inch thick low-E coated, ceramic coated insulated tempered spandrel glazing, as follows:
 - a. Outboard Lite: 1/4-inch thick clear, fully tempered (Kind FT) float glass, low-E coated on the second surface.
 - 1) Low-Emissivity Sputter Coating: Solarban 72 by Vitro Architectural Glass.
 - b. Air Space: 1/2 inch.
 - c. Inboard Lite: 1/4-inch thick clear, fully tempered (Kind FT) float glass, with ceramic coating on the #4 surface
 - 1) Ceramic Coating: Viraspan by Viracon.
 - a) Color: Gray V908.
 - d. Performance Characteristics:
 - 1) Winter Nighttime U-Value: Max. 0.28
 - 2) Summer Daytime U-Value: Max 0.26
- B. Interior Glazing, as Scheduled:
 1. Non-Fire Rated Doors, Transoms, Sidelights and Borrowed Lights: 1/4 inch clear tempered glass.

2. Fire Rated Wood and Hollow Metal Doors, Transoms, Sidelights and Borrowed Lights IGL-F): Laminated ceramic glazing material 5/16 inches thick; "FireLite Plus Premium" by Nippon Electric Glass Co., Ltd., and distributed by Technical Glass Products.
3. Glass Wall, Non-Rated (Designation IGL-1): 3/8" clear glass, fully tempered. Refer to Section 084126 for spacers/gaskets required to be inserted between panels of butt glazed glass.
4. Mirrors: Provide full length mirrors where indicated; sizes as indicated.

END OF SECTION 08 8000

SECTION 08 9000 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section Includes the Following:
 - 1. Fixed, extruded-aluminum louvers.
- B. Related Sections Include the Following:
 - 1. Division 07 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
 - 2. Division 23 Sections for louvers that are a part of mechanical equipment.

1.2 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers.
 - 1. Wind Loads: Uniform pressure (velocity pressure) of 18 lbf per sq. ft. acting inwards.
- B. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

- C. Air-Performance, Water-Penetration, Air-Leakage, and Wind-Driven Rain Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- D. Sustainability Requirements: Cradle 2 Cradle Silver, for louvers.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. 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 blade profiles, angles, and spacing.
- C. Samples for Verification: For each type of metal finish required.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Basis-of-Design Product: The design for each louver is based on the product named. Subject to compliance with requirements, provide either the named product or approved equivalent by one of the other manufacturers specified.
 - a. Construction Specialties.
 - b. Airolite Co.
 - c. Reliable Metal Products.
 - d. Industrial Acoustics Company.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T5 or T-52.T-52.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.
- D. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.
 - 2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
- E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- 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.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Where indicated, provide subsills made of same material as louvers or extended sills for recessed louvers.
- F. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Single Drainable-Blade Louver:

1. Basis-of-Design Product: Construction Specialties, Inc.; Model A4097.
2. Louver Depth: 4-inches (100 mm).
3. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch (2.0 mm).
4. Mullion Type: Fixed.
5. Performance Requirements:
 - a. Free Area: Not less than 8.07 sq. ft. (0.741 sq. m) for 48-inch- (1.2 mm) wide by 48-inch (1.2 mm) high louver.
 - b. Percent Free Area: 50.4
 - c. Point of Beginning Water Penetration: Not less than 1040 fpm (5.28 m/s).
6. Sizes: Refer to Contract Drawings for sizes, configurations, and locations.
7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.5 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 1. Screen Location for Fixed Louvers: Interior face.
 2. Screening Type: Bird screening. NO Insect screening allowed.
- B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 2. Finish: Same finish as louver frames to which louver screens are attached.
- D. Louver Screening for Aluminum Louvers:
 1. Bird Screening: Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm) wire.

2.6 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: 1 inch (25 mm).
 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch (0.81-mm) nominal thickness.
 3. Insulating Core: Rigid, glass-fiber-board insulation.
 4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard channel frames, 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: As selected by Architect.
7. Attach blank-off panels with clips.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish louvers after assembly.

2.8 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 1. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - a. Color(s): As selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 9000

SECTION 09 2116.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Gypsum board shaft wall assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or blotchy 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: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.
- C. VOC Content: Gypsum board panels and finishing materials shall have VOC content meeting the requirements of Section 018113 "Sustainable Design Requirements."

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: 1 hour and 2 hours as indicated.
- B. STC Rating: As indicated.

- C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
 - 1. Depth: 2-1/2 inches, 4 inches and 6 inches as indicated on the Partition Type Drawing.
 - 2. Minimum Base-Metal Thickness: 0.033 inch, 33 mil. .
- D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
- E. Room-Side Finish: As indicated.
- F. Shaft-Side Finish: Gypsum shaftliner board, moisture- and mold-resistant Type X.
- G. Insulation: Sound attenuation blankets.

2.3 PANEL PRODUCTS

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- B. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Lafarge North America, Inc.; Firecheck Type X Shaftliner.
 - b. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner.
 - c. USG Corporation; Sheetrock Brand Gypsum Liner Panel.
 - d. American Gypsum; Shaft Liner.
 - 2. Thickness: 1 inch.
 - 3. Long Edges: Double bevel.
- C. Gypsum Shaftliner Board, Moisture- and Mold-Resistant Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with moisture- and mold-resistant core and surfaces.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Lafarge North America, Inc.; Firecheck Moldcheck Type X Shaftliner.
 - b. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner XP.
 - c. USG Corporation; Sheetrock Brand Mold Tough Gypsum Liner Panel.
 - 2. Thickness: 1 inch.
 - 3. Long Edges: Double bevel.
 - 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- D. Gypsum Board: As specified in Section 09 2900 "Gypsum Board."

2.4 NON-LOAD-BEARING STEEL FRAMING

- A. Steel Framing Members: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

1. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing according to ASTM E 488 conducted by a qualified testing agency.
 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.
- E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from slag wool, or rock wool; provide mineral-fiber SAFB.
- F. Acoustical Sealant: As specified in Section 079200 "Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine 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. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 07 8100 "Applied Fireproofing."

- B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
 - 1. Reinforcing: Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.033-inch (0.84-mm) minimum thickness of base metal (uncoated), accurately positioned and secured behind at least one layer of face panel.
- D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
- E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
- F. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
 - 1. Install control joints on 30 foot maximum centers, for all partitions, at locations indicated, and as detailed. Align control joints with door frames wherever possible, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
- G. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.
- H. Cant Panels: At projections into shaft exceeding 4 inches, install 1/2- or 5/8-inch- thick gypsum board cants covering tops of projections.
 - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
 - 2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft wall framing.
- I. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.4 IDENTIFICATION

- A. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
 - 1. Be located in accessible concealed floor, floor-ceiling or attic spaces.
 - 2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition.
 - 3. Include lettering not less than 0.5 inch in height, incorporating the followings wording: "FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS," or other wording to reflect the wall type as indicated on the Code Summary Drawings.

3.5 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, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 2116.23

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 gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.2 ACTION SUBMITTALS

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

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 according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General:** Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 2. Protective Coating: ASTM A 653, G40, hot-dip galvanized, unless otherwise indicated.
- B. Studs and Runners:** ASTM C 645. EQ studs not permitted.
1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.0296 inch, 30 mils.
 - b. Depth: As scheduled on Drawings for each location.
- C. Slip-Type Head Joints:** Provide one of the following:
1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction

- fit into top runner and with continuous cold rolled channel bridging attached to each stud located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 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) ClarkDietrich; MaxTrak Slotted Deflection Track
 - 2) Steel Network Inc. (The); VertiClip SLD Series.
 - 3) Telling Industries; True-Action™ Slotted Track.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 1. Minimum Base-Metal Thickness: 0.033 inch, 33mil.
- E. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
 1. Depth: 1-1/2 inches unless otherwise indicated.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base-Metal Thickness: 0.018 inch.
 2. Depth: 7/8 inch unless otherwise indicated.
- G. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
 1. Configuration: Asymmetrical.
- H. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
 1. Depth: 3/4 inch unless otherwise indicated.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

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. Hanger Attachments to Concrete:
 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to

- 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Postinstalled, chemical anchor or postinstalled, expansion anchor.
 - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
 - C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
 - D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
 - E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches unless otherwise indicated on Drawings.
 - F. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 - 2. Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.018 inch, 18 mil.
 - b. Depth: As indicated on Drawings.
 - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base-Metal Thickness: 0.018 inch, 18 mil.
 - 4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical or hat shaped.
 - G. Grid Suspension System for Gypsum Board Ceilings and Acoustical Perforated Gypsum Board Assemblies: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Grid System.
 - c. USG Corporation; Drywall Suspension System.
- 2.4 AUXILIARY MATERIALS
- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
 - B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.

- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- E. Cutting, Notching and Boring Holes in Nonstructural Steel Wall Framing:
 - 1. Flanges and lips of nonstructural steel wall studs shall not be cut or notched.
 - 2. Holes in webs of nonstructural steel wall studs shall be permitted along the centerline of the web of the framing member, shall not exceed 1-1/2 inches in width or 4 inches in length, and the holes shall not be spaced less than 24 inches center to center from another hole or less than 10 inches from the bearing end.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
 - 1. Space studs at 16 inches o.c. unless otherwise indicated.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.

- b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches) o.c.
- D. Install steel studs used as furring with clip angles at midpoint of wall span. Install additional clips to limit deflection to L/240 for walls finished with gypsum wall board and L/360 for walls finished with tile or plaster when subject to 5 psf lateral load.
- E. Direct Furring: 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.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 2216

SECTION 09 2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Cement board.
3. Sound-attenuation blankets
4. Sound barrier mullion trim cap at partition to curtainwall connection.

B. Related Requirements:

1. Section 09 2216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
2. Section 09 2116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
2. Sound Barrier Mullion Trim Cap: Full-size sample in 6-inch- (150-mm-) long length in selected finish.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each sound barrier mullion trim cap assembly, for ASTM E 90 tests performed by a qualified third party testing agency.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications (for Sound Barrier Mullion Trim Cap Assembly): Laboratory accredited by IAS as complying with ISO/IEC Standard 17025.

B. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 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.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, 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, those that are moisture damaged, and those that are 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.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace sound barrier mullion trim caps that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Ten years limited warranty from date of Substantial Completion.
 2. Limited warranty does not cover adjacent products or improper installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

- B. **STC-Rated Assemblies:** For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. **Adhesives** shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".

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 Corp.
 - 2. Georgia-Pacific Gypsum LLC.
 - 3. Lafarge North America Inc.
 - 4. National Gypsum Company.
 - 5. USG Corporation.
- B. **Gypsum Wallboard:** ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Where drawings indicate regular type 5/8 inch, provide 5/8 inch Type X indicated below.
 - 3. Long Edges: Tapered.
- C. **Gypsum Board, Type X:** ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
- D. **Gypsum Ceiling Board:** ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
- E. **Moisture- and Mold-Resistant Gypsum Board:** ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces, in 5/8 inch thickness unless otherwise indicated, with tapered edges; panels shall be classified as Type X
 - 1.
 - 2. **Mold Resistance:** ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 - 3. **Products:** Subject to compliance with requirements, provide one of the following or equal:
 - a. National Gypsum Company; Type XP/PR
 - b. United States Gypsum Co.; Mold Tough
- F. **Abuse-Resistant Gypsum Board:** ASTM C 1629/C 1629M.
 - 1. Core: 5/8 inch, Type X.
 - 2. Long Edges: Tapered.

3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
4. Performance Data:
 - a. Surface Abrasion: ASTM C1629. Classification Level 2
 - b. Surface Indentation: ASTM C1629. Classification Level 1
 - c. Soft-body Impact Test: ASTM C1629. Classification Level 1
5. Products: Subject to compliance with requirements, provide one of the following or equal:
 - a. Protecta AR 100 Type X with Mold Defense; Lafarge North America Inc.
 - b. ProRoc Gypsum Board Panels; Certainteed, Division of BPB.

2.4 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.
 1. Products: Subject to compliance with requirements, provide one of the following or equal:
 - a. CertainTeed Corp.; ProRoc Type C.
 - b. Lafarge North America Inc.; Firecheck Type C.
 - c. National Gypsum Company; Gold Bond Fire-Shield C.
 - d. USG Corporation; Firecode C Core.
 2. Thickness: 5/8 inch, unless otherwise indicated.
 3. Long Edges: Tapered.
 4. Provide where required by UL Design or NER 258.

2.5 CEMENT BOARD

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; FiberCement BackerBoard.
 - b. Custom Building Products; Wonderboard.
 - c. James Hardie Building Products, Inc.; Hardiebacker 500.
 - d. National Gypsum Company, Permabase Cement Board.
 - e. USG Corporation; DUROCK Cement Board.
 2. Thickness: 1/2 inch or 5/8 inch as indicated.
 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-coated steel sheet or rolled zinc
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. Expansion (control) joint.
 - f. Curved-Edge Cornerbead: With notched or flexible flanges.

- 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 Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 - 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified
 - 4. Products: Provide Contura curved drywall trim by Gordon Inc. for locations indicated on the Drawings, in sizes required.
- C. Sound Barrier Mullion Trim Cap: Provide sound barrier mullion trim caps of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces. Fabricate from aluminum extrusions minimum 0.125" thick with sound absorbing foam, compressible foam and snap on fastener cover, and as follows:
 - 1. Sound Transmission: STC 50 minimum for single-sided installations and STC 60 or higher for double-sided installations.
 - 2. Sound Absorbing Foam: Meeting ASTM E84, Class A for flammability.
 - 3. Compressible Foam: Between edge of extrusion and interior face of curtain wall glass; of thickness as required to accommodate mullion deflection, color as selected by Architect.
 - 4. Profile: 60 Classic Mullion Trim Cover, with low profile 7/8" return leg.
 - 5. Length: Custom lengths as required to meet project conditions or provide in standard incremental foot lengths cut to exact length at jobsite.
 - 6. Finish: Clear anodized.
 - 7. Basis of Design Product: Mullion Trim Cap by MULL-it-OVER Products, or equal

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Cement Board: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, beveled panel edges, and damaged 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 factory mixed drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use factory mixed drying-type, all-purpose 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 Cement Board: As recommended by manufacturer.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- 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: Provide mineral-fiber SAFB where required by the UL assembly.
- E. Acoustical Joint Sealant: As specified in Section 079200 "Joint Sealants"

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
 - 1. Refer to Section 079200 for additional requirements.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: Vertical surfaces unless otherwise indicated.
 - 2. Ceiling Type: Ceiling surfaces.
 - 3. Abuse-Resistant Type: As indicated on Drawings.
 - 4. Moisture- and Mold-Resistant Type: Provide at all shower rooms where cement board is not indicated.

5. Type C: Where required for specific fire-resistance-rated assembly indicated.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

- D. 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 recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 APPLYING CEMENT BOARD

- A. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated.
- B. Where cement board backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

1. Install control joints on 30 foot maximum centers, for all partitions, at locations indicated, and as detailed. Align control joints with door frames wherever possible, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
 2. Install control joints at 50 foot maximum centers, with areas not to exceed 2,500 sq. ft. for all ceiling areas, at locations indicated, and as detailed.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. Bullnose Bead: Use where indicated.
 3. LC-Bead: Use at exposed panel edges.
 4. L-Bead: Use where indicated.
 5. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.
- E. Sound Barrier Mullion Trim Caps: Install in accordance with manufacturer's directions, in locations indicated on Drawings.

3.6 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.
 2. Level 2: Panels that are substrate for tile.
 3. Level 4: At all panel surfaces that will be exposed to view unless otherwise indicated.
 4. Level 5: Provide Level 5 finish at all areas where wall washed lighting is indicated and at surfaces scheduled to receive gloss paint, and elsewhere specifically indicated on Drawings and schedules.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 IDENTIFICATION

- A. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
1. Be located in accessible concealed floor, floor-ceiling or attic spaces.

2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition.
3. Include lettering not less than 0.5 inch in height, incorporating the followings wording: "FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS," or other wording to reflect the wall type as indicated on the Code Summary Drawings.

3.8 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 2900

SECTION 09 3100 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Porcelain tile
 - 2. Ceramic tile
 - 3. Trim and edge accessories.
 - 4. Waterproof membrane for tile installations
 - 5. Waterproof membrane for shower floors
 - 6. Stone thresholds.
- B. Sealing of expansion, contraction, control, and isolation joints in tile surfaces is specified in Division 07 Section "Joint Sealant."

1.2 ACTION SUBMITTALS

- A. Product data for each type of product specified.
- B. Samples of each color of tile, marble threshold, or accessory to be provided, for verification purposes.
- C. Samples of grout demonstrating full range of colors available, for initial selection purposes.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, plus other information specified.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- B. Single-Source Responsibility for Setting and Grouting Materials: Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.
- C. Installer Qualifications: Engage an experienced Installer who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.

- D. Unit Mock-up: Provide mock-up on a board min. 2' x 2' in size, one for each different tile and grout color to be provided in the work; for final approval of grout color before ordering grout.
- E. In-Place Mock-up: Prepare mock-ups of types indicated below following requirements of this section. Reprepare mock-ups as many times as required by Architect until satisfactory result is obtained, as judged solely by Architect. Obtain Architect's approval of visual qualities before proceeding with work. Protect approved mock-ups until all work has been completed. Approved mock-ups will represent the minimum standard of acceptability for each portion of the work.
 - 1. Provide in-place sample approximately 8'-0" by 8'-0" in size of PT-1 tile installation, located where directed by Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.
- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.
- B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.
- C. Maintain temperatures at 50 deg F (10 deg C) or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturers: The design for each tile type and other material specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the following manufacturers:
 - 1. Tile:
 - a. American Olean; Div. of Dal-Tile International Corp

- b. Creative Materials Corp.
 - c. Crossville Inc
 - d. Daltile; Div. of Dal-Tile International Inc.
 - e. Garden State Tile
 - f. Olympia Tile
 - g. Florida Tile Industries, Inc.
 - h. Mirage Granito Ceramico Spa (Mirage USA)
 - i. Provenza (distributed by Stone Source)
 - j. Stonepeak
 - k. Summitville Tiles, Inc.
 - l. United States Ceramic Tile Company
 - m. Floor Gres Ceramiche (distributed by Stone Source)
2. Mortars and Grouts:
- a. Bostik Construction Products Div. (Hydroment)
 - b. Laticrete International Inc.
 - c. Mapei Corp.
 - d. TEC Specialty Construction Brands Inc.
3. Waterproofing/Crack Isolation Membranes:
- a. Custom Building Products
 - b. The Noble Co.
 - c. Mapei Corp.
4. Shower Floor Waterproofing Membrane: Schluter or equal.
5. Termination, Trim and Transition Strips: Schluter

2.2 PRODUCTS, GENERAL

- A. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types, compositions, and grades of tile indicated.
1. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.
- B. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.
- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
- 1. Match color, texture, and pattern indicated by reference to manufacturer's standard designations for these characteristics.
 - 2. Provide tile trim and accessories that match color and finish of adjoining flat tile.

- D. **Factory Blending:** For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory and package accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
- E. **Large Format Tiles:** Large format tiles are defined to be tiles with any one single side larger than 15".
- F. **Adhesives, Mortars and Grout, Waterproofing Membranes:** Products shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".

2.3 TILE PRODUCTS

- A. **Porcelain Floor Tile PT-1:** Wood effect porcelain tiles complying with the following requirements:
 - 1. Module Size: 30 x 120 cm (11-13/16" x 47-1/4")
 - 2. Edges: Rectified
 - 3. Finish: Naturale (matte)
 - 4. Color: As scheduled
 - 5. Basis of Design Product: Ceramiche Caesar "LIFE" or equal.
- B. **Porcelain Floor Tile PT-2:** Provide colorbody porcelain tile complying with the following requirements:
 - 1. Module Size: 12 by 24 inches.
 - 2. Thickness: 3/8 inch
 - 3. Finish: Matte
 - 4. Color: As scheduled
 - 5. Basis of Design Product: Daltile "Santino" or equal.
- C. **Porcelain Floor Tile PT-3:** Provide colorbody porcelain tile complying with the following requirements:
 - 1. Module Size: 12 by 24 inches.
 - 2. Thickness: 7/16 inch
 - 3. Finish: Unpolished
 - 4. Color: As scheduled
 - 5. Basis of Design Product: Daltile "Formula" or equal.
- D. **Porcelain Floor Tile PT-4:** Provide colorbody porcelain tile complying with the following requirements:
 - 1. Module Size: 12 by 24 inches.
 - 2. Thickness: 3/8 inch
 - 3. Finish: Matte
 - 4. Color: As scheduled
 - 5. Basis of Design Product: Daltile "Fabrique" or equal.

E. Ceramic Wall Tile (CT-1): Provide tile complying with the following requirements:

1. Module Size: 4" x 12"
2. Thickness: 5/16"
3. Surface Finish: Semi-gloss
4. Color(s): As scheduled
5. Basis of Design Product: Color Wheel Collection - Linear series by Daltile or equal.

F. Trim Units: Provide tile trim units and to comply with following requirements:

1. CTB-1: Provide flat top cove base with preformed internal and external corners, as follows:
 - a. Size: 4" x 12"
 - b. Finish: Semi-gloss
 - c. Colors: As scheduled
 - d. Basis of Design Product: Color Wheel Collection - Linear series by DalTtle or equal.
2. PTB-1: Provide cove base with preformed internal and external corners, as follows:
 - a. Size: 6" x 12".
 - b. Finish: Unpolished
 - c. Color: As scheduled
 - d. Basis of Design Product: Formula Collection by Daltile or equal.

2.4 STONE THRESHOLDS

- A. General: Provide stone that is uniform in color and finish, fabricated to sizes and profiles indicated or required to provide transition between tile surfaces and adjoining finished floor surfaces.
1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch (12.7 mm) or less, and finish bevel to match face of threshold.
- B. Marble Thresholds: Provide marble thresholds complying with ASTM C 503 requirements for exterior use and for abrasion resistance where exposed to foot traffic, a minimum hardness of 10 per ASTM C 241.
1. Provide white marble thresholds.

2.5 WATERPROOFING/CRACK ISOLATION FOR TILE INSTALLATIONS

- A. General: Provide products that comply with ANSI A118.10 and the descriptions in this Article.
- B. Polyethylene-Sheet Waterproofing/Crack Isolation: Manufacturer's standard proprietary product consisting of composite sheets, 60 inches (1524 mm) wide by a nominal

thickness of 0.030-inch (0.76 mm), composed of an inner layer of nonplasticized, chlorinated polyethylene sheet faced on both sides with laminated, high-strength, nonwoven polyester material, designed for embedding in latex-portland cement mortar and as the substrate for latex-portland cement mortar setting bed. Provide at all locations for thin-setting.

1. Products: Provide Nobleseal TS manufactured by the Noble Company, or approved equal.
2. Location: Use at all thin set tile floors in bathrooms.

2.6 SHOWER FLOOR WATERPROOFING MEMBRANE

- A. Waterproofing membrane .0008 inch thick composed of polyethylene membrane with fleece covering both sides. Provide for walls and floors of shower. Provide all corner strips and flashing shapes as required for complete installation.

1. Basis of Design Product: KERDI by Schluter, or equal.

2.7 SETTING MATERIALS

- A. Medium-Bed, Latex-Portland Cement Mortar. Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of up to 3/4 inch. Provide one of the following, or approved equal:

1. MegaLite® Ultimate Crack Prevention Large Format Tile Mortar by Custom Building Products.
2. 4-XLT by Laticrete.
3. Large Tile and Stone Mortar by Mapei

- B. Latex-Portland Cement Mortar: Two component mortar system, comply with ANSI A118.4. Provide one of the following, or approved equal:

1. Laticrete 317 with Laticrete 333 additive; Laticrete International, Inc.
2. Kerabond with Keralastic; Mapei Corp.
3. Or equivalent.

2.8 GROUTING MATERIALS

- A. Water-Cleanable Epoxy Grout: ANSI A118.3. with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Grout shall be stain resistant, color fast, mold and mildew inhibiting, non-sag, suitable for joints 1/16" to 1/2" and sanded type suitable for installing with glazed tiles.

1. Basis of Design Product: Laticrete "Spectralock Pro Epoxy Grout" or equal.
2. Colors: As scheduled, or if not scheduled, as selected by Architect.

2.9 MISCELLANEOUS MATERIALS

- A. Metal Edge Strips: Zinc alloy or stainless steel terrazzo strips, 1/8-inch wide at top edge with integral provision for anchorage to mortar bed or substrate unless otherwise indicated.
- B. Notched Trowel: Use type recommended by tile manufacturer for setting large-format tiles, for setting bed thickness utilized.
- C. Termination, Trim and Transition Strips: Provide Schluter units as scheduled below, or indicated on Drawings.
 - 1. At stair tread nosings, provide Schluter stainless steel ribbed nosing strips "TREP-EFK".
 - 2. At wall tile, provide Schluter stainless steel units "Jolly" at outside corners and end pieces that do not butt into a wall or corner.
- D. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by tile manufacturer for applications indicated.
- E. Grout Release: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 - 1. Mapei "UltraCare Grout Release".
 - 2. Miracle Sealants Co. "511 Impregnator"
- F. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- G. Grout Sealers: Water-based sealer for tile for protection from stains, as follows:
 - 1. Mapei "UltraCare Grout Sealer".
 - 2. Miracle Sealants Co. "511 Impregnator"

2.10 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 - 3. Verify that subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.
 - 4. Perform moisture test at rate of one per 2,000 sq.ft.
 - 5. Verify that concrete substrates are within the flatness tolerances required for setting large format tiles.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with manufacturer's installation specifications to prepare substrates indicated to receive tile.
- B. Use trowelable leveling and patching compounds per manufacturer's directions to fill cracks, holes, and depressions in substrates and to patch and level floors as required to provide suitable substrate for tile application.
- C. Remove coatings, including curing compounds, and other substances that could interfere with adhesion of tile by using a grinder, sander, or polishing machine with a heavy-duty wire brush.
- D. Broom or vacuum clean substrates to be covered by tiles immediately before tile installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.
- E. Blending: For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in 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.
- F. For large format floor tile thin-set with medium bed mortar, level floor to 1/8-inch variance in 10 feet, with no more than 1/16 inch variation in 24 inches by one of the following methods:
 - 1. Provide self-leveling hydraulic cement underlayment throughout project where new tile is installed.
 - 2. Grind concrete substrate and patch with trowelable leveling and patching compound to achieve indicated flatness.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" that apply to type of setting and grouting materials and methods indicated.
- B. TCNA Installation Guidelines: TCNA "Handbook for Ceramic Tile Installation"; comply with TCNA installation methods indicated.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. 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 that plates, collars, or covers overlap tile.
 - 1. Cut and grind tile edges where they abut curved surfaces to produce a close and uniform abutting joint.
- E. Jointing Pattern: Lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.
- F. Tile Patterns: Comply with pattern indicated on drawings.
- G. Expansion Joints: Provide expansion joints, control joints and pressure relieving joints of widths and at locations as per TCNA Handbook Construction #EJ171. Do not saw cut joints after installation of tiles.
 - 1. Sealing of joints is included in Division 07 Section "Joint Sealers."
- H. Apply grout release to tile surfaces prior to grouting. Prepare a small mock-up area of grout release application for Architect's approval before proceeding with application of grout release to installed tile surfaces.
- I. Grout tile to comply with ANSI A108.10.

3.4 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

- B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 FLOOR INSTALLATION METHODS

- A. Floor Tile: Install tile to comply with requirements indicated below for setting bed methods, TCNA installation methods related to types of subfloor construction, and grout types:
 - 1. Concrete subfloor, TCNA F205, modified to comply with tile manufacturer's installation instructions, and as follows:
 - a. Bond Coat for Tile: Medium-Bed, Latex-Portland Cement Mortar, ANSI A108.5 over subfloor.
 - b. Grout: Epoxy.
 - c. Setting bed thickness shall be as required to produce finished floor surface at correct level for project.
 - d. Provide at stair landings and non-wet areas only.
 - 2. Concrete subfloor with waterproofing/crack suppression membrane, TCNA F205 modified to comply with membrane manufacturer's installation instructions, details on drawings and as follows:
 - a. Bond Coat for Membrane: Medium-Bed, Latex-Portland Cement Mortar, ANSI A108.5 over subfloor.
 - b. Sheet membrane over bond coat, extend up walls 4 inches
 - c. Bond Coat for Tile: Medium-Bed, Latex-Portland Cement Mortar—ANSI A108.5 over membrane
 - d. Grout: Epoxy.
 - e. Provide at bathrooms.
- B. Joint Widths:
 - 1. PT-1: 2 to 3 mm (less than 1/8")
 - 2. PT-2, PT-3 and PT-4: 1/8"
- C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
- D. Metal Tread Nosings: Adhere metal edge nosing strips to concrete treads in accordance with manufacturer's directions.
- E. Stone Thresholds: Install stone thresholds at tile transitions at restrooms. Allow for bevel/chamfer as required. Set in same type of setting bed as abutting field tile unless otherwise indicated. Sealant is specified in Section 079200.

3.6 WALL INSTALLATION METHODS

- A. Wall Tile: Install tile to comply with requirements indicated below for setting-bed methods, TCNA installation methods related to subsurface wall conditions, and grout types:
 - 1. Gypsum Board - TCNA W243, and as follows:
 - a. Bond Coat for Tile: Latex-portland cement mortar, ANSI A108.5 over gypsum board.
 - b. Grout: Epoxy.
- B. Joint Widths: 1/16".

3.7 CLEANING AND PROTECTION

- A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
- C. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Substantial Completion.
 - 1. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09 3100

SECTION 09 3116 - CEMENT TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Encaustic cement tile
- B. Sealing of expansion, contraction, control, and isolation joints in tile surfaces is specified in Division 07 Section "Joint Sealant."

1.2 ACTION SUBMITTALS

- A. Product data for each type of product specified.
- B. Samples of each color of tile, grout, and accessory to be provided, for verification purposes.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, plus other information specified.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- B. Single-Source Responsibility for Setting and Grouting Materials: Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.
- C. Installer Qualifications: Engage an experienced Installer who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.
- D. Unit Mock-up: Provide mock-up on a board min. 2' x 2' in size, one for each different tile and grout color to be provided in the work; for final approval of grout color before ordering grout.
- E. In-Place Mock-up: Prepare mock-ups of types indicated below following requirements of this section. Reprepare mock-ups as many times as required by Architect until satisfactory result is obtained, as judged solely by Architect. Obtain Architect's approval

of visual qualities before proceeding with work. Protect approved mock-ups until all work has been completed. Approved mock-ups will represent the minimum standard of acceptability for each portion of the work. approved mock-ups may be incorporated in the finished work.

1. Provide in-place sample 2 feet by 2 feet in size for each type of tile to be provided, located where directed by Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.
- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.
- B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.
- C. Maintain temperatures at 50 deg F (10 deg C) or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturers: The design for each tile type and other material specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the following manufacturers:
 1. Tile:
 - a. Cement Tile Shop
 - b. Cle' Tile
 - c. New York Cement Tile
 2. Mortars and Grouts:
 - a. Bostik Construction Products Div. (Hydroment)
 - b. Laticrete International Inc.
 - c. Mapei Corp.

d. TEC Specialty Construction Brands Inc.

2.2 PRODUCTS, GENERAL

- A. Standard for Cement Tile: Comply with CTMA Handbook for Concrete Tiles published by the Concrete Tile Manufacturer's Association for types and material composition of cement tiles.
- B. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.
- C. Cement Tiles Composition: Hydraulic pressed handmade cement tiles fabricated from grey portland cement and sand, with a wear colored layer 3 to 4 mm thick affixed to the tile body by 1700 psi mechanical pressure, composed of white portland cement, marble dust and mineral pigments for color (oxides and organic).
- D. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
 - 1. Match color, texture, and pattern indicated by reference to manufacturer's standard designations for these characteristics.
- E. Presealed Cement Tiles: Provide factory pre-sealed and pre-polished tiles.
- F. Low-Emitting Materials: Grouts and setting materials shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".

2.3 TILE PRODUCTS

- A. Cement Wall Tile CMT-1: Provide precast cement tiles fabricated from portland cement, aggregates and admixtures, complying with the following requirements:
 - 1. Compressive Strength: Minimum 4000 psi.
 - 2. Module Size: 8 by 8 inches.
 - 3. Thickness: 5/8 inch
 - 4. Shape: Square.
 - 5. Color: As scheduled.
 - 6. Texture: Smooth
 - 7. Basis of Design Product: Cle Tile "Criss Cross" or equal.
 - 8. Location: As scheduled
- B. Cement Wall Tile CMT-2: Provide precast cement tiles fabricated from portland cement, aggregates and admixtures, complying with the following requirements:
 - 1. Compressive Strength: Minimum 4000 psi.
 - 2. Module Size: 8 by 9 inches.

3. Thickness: 5/8 inch
4. Shape: Hex.
5. Color: As scheduled.
6. Texture: Smooth
7. Basis of Design Product: Cle Tile "Radar Hex" or equal.
8. Location: As scheduled

- C. Cement Wall Tile CMT-3: Provide precast cement tiles fabricated from portland cement, aggregates and admixtures, complying with the following requirements:

1. Compressive Strength: Minimum 4000 psi.
2. Module Size: 8 by 8 inches.
3. Thickness: 5/8 inch
4. Shape: Square.
5. Color: As scheduled.
6. Texture: Smooth
7. Basis of Design Product: Cle Tile "Diamond Twist" or equal.
8. Location: As scheduled.

2.4 TILE ACCESSORIES

- A. Preformed Metal Base: Anodized aluminum, cove-shaped profile for transitions between walls to be tiled and previously finished floors. Units shall have a single trapezoid-perforated anchoring leg that is secured in the mortar bond coat and a dovetailed channel which is bonded to floor surfaces

1. Provide inside and outside corners, and end caps.
2. Finish: Anodized, in color selected by Architect.
3. Basis of Design Product: Schluter®-DILEX-AHKA or equal.

2.5 SETTING MATERIALS

- A. Latex-Portland Cement Mortar: Two component mortar system, comply with ANSI A118.4. Provide one of the following, or approved equal:

1. Laticrete 317 with Laticrete 333 additive; Laticrete International, Inc.
2. Kerabond with Keralastic; Mapei Corp.
3. Or equivalent.

2.6 GROUTING MATERIALS

- A. Pre-Mixed Quartz Aggregate Based Grout: Professional-grade, ready-to-use specialty grout formulated with color-coated quartz aggregate, meeting tests in ANSI A118.3. and ANSI A118.6, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Grout shall be stain resistant, color fast, mold and mildew inhibiting, non-sag, suitable for joints 1/16" to 1/2" and suitable for installing cement tiles.

1. Basis of Design Product: Mapei "Flexcolor CQ" or equal.
2. Colors: As scheduled.

2.7 MISCELLANEOUS MATERIALS

- A. Grout Release: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 1. Mapei "UltraCare Grout Release".
 2. Miracle Sealants Co. "511 Impregnator"
- B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- C. Grout Sealers: Water-based sealer for tile for protection from stains, as follows:
 1. Mapei "UltraCare Grout Sealer".
 2. Miracle Sealants Co. "511 Impregnator"

2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 1. Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.
 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with manufacturer's installation specifications to prepare substrates indicated to receive tile.
- B. Remove coatings, including curing compounds, and other substances that could interfere with adhesion of tile by using a grinder, sander, or polishing machine with a heavy-duty wire brush.
- C. Broom or vacuum clean substrates to be covered by tiles immediately before tile installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.
- D. Blending: Blend tiles at Project site before installing. Mix tiles from all cases to ensure cement tiles share an array of variations.
- E. Acclimatize tiles to installation environment minimum 7 days prior to installation.
- F. Soak tiles in clean, potable water a few seconds prior to setting.

3.3 INSTALLATION, GENERAL

- A. Installation Standard for Cement Tile: Comply with CTMA Handbook for Concrete Tiles published by the Concrete Tile Manufacturer's Association and tile manufacturer's installation instructions..
- B. TCNA Installation Guidelines: TCNA "Handbook for Ceramic Tile Installation"; comply with TCNA installation methods indicated.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. 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 that plates, collars, or covers overlap tile.
 - 1. Cut and grind tile edges where they abut curved surfaces to produce a close and uniform abutting joint.
- E. Jointing Pattern: Lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.
- F. Tile Patterns: Comply with pattern indicated on drawings.

- G. Expansion Joints: Provide expansion joints, control joints and pressure relieving joints of widths and at locations as per TCNA Handbook Construction #EJ171. Do not saw cut joints after installation of tiles.

- 1. Sealing of joints is included in Division 07 Section "Joint Sealers."

- H. Metal Accessory Units: Install as per manufacturer's directions.

- I. Apply grout release to tile surfaces prior to grouting. Prepare a small mock-up area of grout release application for Architect's approval before proceeding with application of grout release to installed tile surfaces.

- J. Grout tile to comply with ANSI A108.10.

- K. Seal tile work after grouting.

3.4 WALL INSTALLATION METHODS

- A. Wall Tile: Install tile to comply with requirements indicated below for setting-bed methods, TCNA installation methods related to subsurface wall conditions, and grout types:

- 1. Gypsum Board - TCNA W243, and as follows:
 - a. Bond Coat for Tile: Latex-portland cement mortar, ANSI A108.5 over cement board.
 - b. Grout: Pre-mixed quartz aggregate based grout.

- B. Joint Widths: 1/16".

3.5 CLEANING AND PROTECTION

- A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

- 1. Remove grout residue from tile as soon as possible.
 - 2. Use cleaning methods and cleaning agent recommended by tile manufacturer.

- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

- C. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Substantial Completion.

- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09 3116

SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes ceilings consisting of acoustical panels and exposed suspension systems.
- B. Related Sections include the following:
 - 1. Acoustical sealants are specified in Division 07 Section "Joint Sealants"

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product specified
- B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Ceiling suspension members.
 - 2. Method of attaching hangers to building structure.
 - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 4. Minimum Drawing Scale: 1:100
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on samples of size indicated below.
 - 1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.
 - 2. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings, for each color and system type required.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Indicate compliance of acoustical panel ceilings and components with requirements based on comprehensive testing of current products.
- B. Research/Evaluation Reports: Evidence of acoustical panel ceiling's and components' compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
- C. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer..
- C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
 - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency .
 - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
 - a. Flame Spread: 25 or less
 - b. Smoke-Developed Index: 450 or less

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges, soiling panels or damaging units in any way.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Acoustical Ceiling Components: 2% of each type of panel installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Acoustical panels shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".
- B. Acoustical panels shall meet the requirements of ASTM E84 for Class A flame spread and smoke developed.

2.2 MANUFACTURERS

- A. Basis of Design Products: Subject to compliance with requirements, provide specified products by Armstrong World Industries or equivalent products by one of the following:
 - 1. CertainTeed
 - 2. USG Interiors

2.3 ACOUSTICAL PANELS

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - 1. Mounting Method for Measuring Noise Reduction Coefficient: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
 - 2. Provide fire-resistance rated panels where indicated.
- B. Acoustical Panels for Acoustical Panel Ceiling ACT-1: Where this designation is indicated, provide acoustical panels complying with the following:

1. Classification: Panels fitting ASTM E 1264 for Type XII, fiberglass with membrane-faced overlay; Form 2, water felted.
2. Pattern: Panels fitting ASTM E 1264 pattern designation (description) E (lightly textured).
3. Color: White.
4. Light Reflectance Coefficient: Not less than LR 0.90.
5. Noise Reduction Coefficient: 0.90
6. Ceiling Attenuation Class: N/A
7. AC: 180
8. Fire Rating: Class A
9. Sag Resistance Treatment: Armstrong HumiGuard Plus
10. Anti-Mold and Mildew Treatment: Inherent
11. Warranty: 30 year
12. Sustainability: Plant-based material.
13. Edge Detail: Square lay-in.
14. Thickness: 3/4 inch.
15. Size: 24 by 24 inches.
16. Basis of Design Product: Armstrong Optima Square Lay-in #3150PB.
17. Location: As scheduled.

C. Acoustical Panels for Acoustical Panel Ceiling ACT-2: Where this designation is indicated, provide acoustical panels complying with the following:

1. Classification: Panels fitting ASTM E 1264 for Type XII, fiberglass with membrane-faced overlay; Form 2, water felted.
2. Pattern: Panels fitting ASTM E 1264 pattern designation (description) E (lightly textured).
3. Color: White.
4. Light Reflectance Coefficient: Not less than LR 0.90.
5. Noise Reduction Coefficient: 0.90
6. Ceiling Attenuation Class: N/A
7. AC: 180
8. Fire Rating: Class A
9. Sag Resistance Treatment: Armstrong HumiGuard Plus
10. Anti-Mold and Mildew Treatment: Inherent
11. Warranty: 30 year
12. Sustainability: Plant-based material.
13. Edge Detail: Square lay-in.
14. Thickness: 3/4 inch.
15. Size: 24 by 48 inches.
16. Basis of Design Product: Armstrong Optima Square Lay-in #3151PB.
17. Location: As scheduled.

2.4 METAL SUSPENSION SYSTEMS

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

1. Provide fire-resistance rated metal suspension system where indicated
 - B. Suspension System for Acoustical Panel Ceilings ACT-1 and ACT-2: Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z120) coating designation, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges; other characteristics as follows:
 1. Structural Classification: Intermediate-duty system.
 2. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
 3. Face Design: Flush face.
 4. Cap Material: Steel sheet.
 5. Cap Finish: Manufacturer's standard factory-applied painted finish in white.
 6. Basis of Design Product: Armstrong Prelude XL.
 - C. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
 1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
 - D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.
 - E. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish and color as that used for exposed flanges of suspension system runners.
 - F. Hold-Down Clips: Where indicated or required for fire-rating, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.
- 2.5 ACOUSTICAL SEALANT
- A. Refer to Division 07 Section "Joint Sealants".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage, and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.
- B. 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, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - 1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
 - 2. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- 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. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for

- substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not attach hangers to steel deck tabs.
 6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 7. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches (200 mm) from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m). Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as indicated on reflected ceiling plans.
 2. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113

SECTION 09 5429 - WOOD GRILLE AND PLANK CEILING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes wood grilles and wood planks for installation as ceiling systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product specified
- B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Layout of linear planks and slats of grilles in relation to room orientation
 - 2. Joint patterns between planks and grille units.
 - 3. Ceiling suspension members.
 - 4. Method of attaching hangers to building structure.
 - 5. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 6. Minimum Drawing Scale: 1:100
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on samples of size indicated below.
 - 1. 12-inch- (300-mm-) square samples of each grille and plank type, pattern, and color.
 - 2. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings, for each color and system type required.
 - 3. Minimum 6" long section of each type of wood molding and trim required.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Indicate compliance of grille and plank ceilings and components with requirements based on comprehensive testing of current products.
- B. Research/Evaluation Reports: Evidence of grille and plank ceilings' and components' compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
- C. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed grille and plank ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of grille and plank ceiling system including all attachment and suspension components through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grilles and planks and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing grilles and planks, permit them to reach room temperature and a stabilized moisture content.
- C. Handle grilles and planks carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install grille and plank ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

- A. Coordinate layout and installation of grilles and planks 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.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Composite Wood Products: Products shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".
- B. Fire-Test-Response Characteristics: Provide grille and plank ceilings that comply with the following requirements:
 - 1. Surface-Burning Characteristics: Provide grille and planks meeting Class A requirements tested per ASTM E 84.

2.2 WOOD PLANK SYSTEM

- A. Flat Wood Veneer Planks System (WDC-1): Wood veneer planks mounted on linear carriers with integral clips to maintain spacing of planks, as follows:
 - 1. Wood Planks: Fire-retardant particle board core with face-cut veneers, and factory-applied black fleece on the back of each plank to cover the reveal.
 - a. Plank Size: 96" L x 5-1/4" W x 3/4" thick
 - b. Wood Veneer: Natural Variations (real wood) Walnut (NWN)
 - c. Edge Treatment: Exposed edges along the edge shall be edge banded to match plank face; ends of planks shall be unfinished.
 - 2. Plank Spacing: 3/4" reveal
 - 3. Fire Rating: Class A
 - 4. NRC: 0.50
 - 5. Finish: Factory finish with clear or tinted semigloss coating.
 - 6. Basis of Design Product: Woodworks Linear Nominal 6" Module, #6660W1NWN by Armstrong, or equal.
- B. Suspension System for Flat Veneer Planks: 12" HD Linear Carriers (concealed) with integral clips (factory-applied) for nominal 6" modules.
 - 1. Color: Black
 - 2. Size: 144" x 15/16" x 1-11/16"
 - 3. Basis of Design Product: Suspension System #5371 by Armstrong or equal.
- C. Accessories:
 - 1. Provide acoustic batt infill above planks to achieve desired NRC rating; BioAcoustic Infill Panel #5479 in beige matte color by Armstrong, or equal.
 - 2. Provide Woodworks Veneer Trim in color to match planks and in size as indicated on Drawings.
 - 3. Provide all metal installation accessories as required for complete installation.

2.3 WOOD GRILLE SYSTEM

- A. Wood Grille Panels System (WDC-2): Solid wood strips factory fabricated into open grille panels with black spacers applied to slat backs to space wood slats apart, as follows:
 - 1. Wood Slats: Poplar slats 5/8" w x 1-3/8" h fabricated into panels.
 - 2. Panel Configuration: 8 slats per panel, spaced 7/8" apart using black backer strips to produce panels 12" W x 96" L x 1-7/8" H, with 58% open area.
 - 3. Fire Rating: Class A; provide intumescent treatment to provide this rating.
 - 4. NRC: 0.85
 - 5. CAC: 28
 - 6. Finish: Factory finish with clear or tinted semigloss coating.
 - 7. Color: Grille Walnut (GWN)
 - 8. Basis of Design Product: Woodworks Grille, #7264BOGWN by Armstrong, or equal.

- B. Suspension System for Wood Grille Panels: manufacturer's standard wide-face, capped, double-web, steel suspension system with main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z120) coating designation, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges; other characteristics as follows:

1. Face Design: Flush face.
2. Cap Material: Steel sheet.
3. Cap Finish: Manufacturer's standard factory-applied painted finish in black.
4. Product: Armstrong Prelude XL or equal.

- C. Accessories:

1. Provide acoustic batt infill above grilles to achieve desired NRC and CAC ratings; BioAcoustic Infill Panel #5823 in black matte color by Armstrong, or equal.
2. Provide Woodworks Solid Wood Trim in finish to match slats and in size as indicated on Drawings.
3. Provide all metal installation accessories, including junction accessories, backer clips and end caps, as required for complete installation.

- D. Fabricate drop down access panels in grille material in sizes as indicated on Drawings.

2.4 METAL SUSPENSION SYSTEM ACCESSORIES

- A. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.

1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

- B. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which grilles and planks and suspension systems attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage, and other conditions affecting performance of wood ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other anchors whose installation is specified in other Sections.
- B. Measure each area and establish layout of planks and grilles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width planks and grilles at borders, and comply with layout shown on reflected ceiling plans and shop drawings.

3.3 CEILING INSTALLATION

- A. General: Install plank and grille ceilings to comply with publications referenced below per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
 - 1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
- 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. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Do not attach hangers to steel deck tabs.
 - 6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 7. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches (200 mm) from ends of each member.

- C. Install edge moldings and trim of type indicated at perimeter of ceiling areas and where necessary to conceal edges of planks and grilles.
- 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 planks and grilles with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut planks and grilles at borders and penetrations to provide a neat, precise fit.
 - 1. Arrange directionally patterned planks and grilles as indicated on reflected ceiling plans.
 - 2. Install clips to attach planks and grilles to suspension system in conformance with manufacturer's directions.
- F. Install acoustical infill batts in accordance with manufacturer's directions.

3.4 CLEANING

- A. Clean exposed surfaces of grilles and planks, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5429

SECTION 09 6500 - RESILIENT FLOORING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Installation of Owner furnished luxury vinyl tile.
 - 2. Vinyl composition tile, static dissipative (SDT-1).
 - 3. Resilient wall base.
 - 4. Resilient flooring accessories.

1.2 ACTION SUBMITTALS

- A. Product data for each type of product specified.
 - 1. Include product data for adhesives and sealers, including printed statement of VOC content indicating compliance with requirements for low-emitting materials.
- B. Samples for verification purposes in form of actual flooring or sections of accessories for each color and type.
- C. Shop Drawings: Indicate decorative pattern layout, if any. Show location of seams and edges. Indicate location of columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutout locations.
 - 1. Indicate layout for copper grounding strips for static dissipative flooring.

1.3 INFORMATIONAL SUBMITTALS

- A. Maintenance data for resilient flooring and accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient materials on flat surface in dry space protected from the weather with ambient temperatures maintained between 50 deg F (10 deg C) and 90 deg F (32 deg C).
- B. Move floor coverings and installation accessories into spaces where they will be installed at least 48 hours before installation, unless longer conditioning periods are recommended in writing by manufacturer.

1.5 PROJECT CONDITIONS

- A. Maintain a minimum temperature of 70 deg F (21 deg C) in spaces to receive resilient flooring for at least 72 hours prior to installation, during installation, and for not less than

72 hours after installation. After this period, maintain a temperature of not less than 55 deg F (13 deg C).

- B. Moisture Testing of Concrete Substrates: Perform moisture tests recommended by manufacturer and as follows:
 - 1. Testing Procedures: Perform calcium chloride or moisture meter tests as required by floor topping and resilient tile manufacturers.
 - a. Calcium Chloride Testing: Anhydrous calcium chloride test, ASTM F 1869.
 - b. Moisture Meter Testing: Relative humidity test using in situ probes, ASTM F 2170.
 - 2. Proceed with installation only after substrates do not exceed maximum moisture-vapor-emission rate or relative humidity level measurement acceptable to flooring material manufacturer.
- C. Do not install flooring or accessories until they are at the same temperature as the space where they are to be installed.
- D. Close spaces to traffic during flooring installation.

1.6 SEQUENCING AND SCHEDULING

- A. Install flooring and accessories after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

- A. Extra Materials: Furnished from same production run as resilient flooring installed. Furnish 2 boxes of each type and color of material provided in the work. Package materials with protective covering and identify with labels describing contents. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire Performance Characteristics: Provide resilient flooring with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45 watts per sq. cm or more per ASTM E 648.
 - 2. Smoke Density: Less than 450 per ASTM E 662.
- B. Sustainability Requirements: Resilient flooring shall comply with RFCI FloorScore Program.

- C. Resilient flooring shall not contain PVC, plasticizers, ortho-phthalates, halogens, asbestos, or Red List Chemicals of Concern.

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:

- 1. Tiles:
 - a. Armstrong Flooring
 - b. Mannington
 - c. Mohawk Group
 - d. Flexco
 - e. Nora systems
 - f. Patcraft
 - g. Shaw Hard Surface
 - h. Tarkett
- 2. Base and Other Accessories:
 - a. Armstrong
 - b. Endura
 - c. Roppe
 - d. Tarkett

2.3 RESILIENT TILE FLOORING

- A. Luxury Vinyl Tile: Products furnished by Owner.
- B. Vinyl Composition Tile, Static Dissipative (SDT-1): ASTM F 1066, Class 2, through-pattern, with static-dissipative properties and as follows .
 - 1. Thickness: 1/8"
 - 2. Tile Size: 12" x 12"
 - 3. Factory Finish: Fast Start
 - 4. Color: As scheduled.
 - 5. Basis of Design Product: Excelon SDT Static Dissipative Tile by Armstrong, or equal.

2.4 RESILIENT WALL BASE

- A. Resilient Wall Base: ASTM F 1861, Type TS, Group 1 (solid), 4" high, 1/8" thick, smooth surface, and as follows:
 - 1. Style: Straight cove base with toe (set-on type)
 - 2. Lengths: Coils in manufacturer's standard length.
 - 3. Inside and Outside Corners: Preformed.

4. Products: Rubber Base by Johnsonite/Tarkett.
5. Colors: As selected by Architect from full range.

2.5 MISCELLANEOUS RESILIENT ACCESSORIES

- A. Resilient Accessory Moldings: Products furnished by Owner, including carpet edge for glue-down applications, carpet nosing, nosing for resilient tile, reducer strip for resilient flooring, and tile and carpet joiner.

2.6 INSTALLATION ACCESSORIES

- A. Adhesives, primers and sealants shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".
- B. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.
- C. Concrete Sealer: Type recommended and approved by resilient flooring manufacturer and adhesive manufacturer to ensure proper adhesion of resilient flooring to substrate.
- D. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- E. Adhesives: Provide adhesives as recommended by flooring and accessory manufacturer to obtain their warranty.
- F. Static Dissipative Tile Accessories: Provide Static Dissipative Tile Adhesive with 2 in. wide x 24 in. long copper ground-connection strips for under the tile

PART 3 - EXECUTION

3.1 EXAMINATION

- A. General: Examine areas where installation of flooring will occur, with Installer present, to verify that substrates and conditions are satisfactory for flooring installation and comply with flooring manufacturer's requirements and those specified in this Section.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond tests recommended by flooring manufacturer.
 2. Finishes of subfloors comply with tolerances and other requirements specified in Division 03 Section "Cast-In-Place Concrete" for slabs receiving resilient flooring.

3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.
- C. Concrete Moisture Emission Tests: Perform calcium chloride test as per manufacturer's directions, as follows, and other tests if recommended by resilient flooring and adhesive manufacturer:
 1. Perform moisture test at rate of one per 2,000 sq.ft. of new and existing floor area to be covered.
 2. Report test results in writing to Architect, and Contractor within 24 hours after tests are completed. Reports of concrete moisture emission tests shall contain the Project identification name and number, date of test location of test within structure.
 3. Perform additional moisture emission tests of in-place concrete when test results indicate specified moisture content has been exceeded, as directed by Architect.
 - a. Repeat test one week after initial test minimally and additionally repeat test if required by field conditions to determine moisture levels in area of resilient flooring application.
- D. Do not proceed with installation until unsatisfactory conditions have been corrected.
- E. Only if it is not possible to provide a concrete substrate with acceptable moisture levels, then a surface applied moisture mitigation system shall be used that meets the requirements of ASTM F3010 Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings.

3.2 PREPARATION

- A. General: Comply with manufacturer's installation specifications to prepare substrates indicated to receive flooring.
- B. Use trowelable leveling and patching compounds per flooring manufacturer's directions to fill cracks, holes, and depressions in substrates and to patch and level floors as required to provide suitable substrate for flooring application.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives by using a grinder, sander, or polishing machine with a heavy-duty wire brush.
- D. Broom or vacuum clean substrates to be covered by flooring immediately before installation of flooring. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.
- E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.
- F. Seal concrete substrates as required by moisture test results to ensure proper adhesion of resilient flooring to substrate.

- G. Grounding Static Dissipative Tile: Install per manufacturer's instructions and approved shop drawings. Following is Basis of Design Product installation Instructions:
1. Apply adhesive to clean, prepared substrate and allow to dry to the touch.
 2. Cut copper grounding strips into 2 ft strips. Apply to substrate with minimum 18 inches remaining under the flooring and extending up the wall to a predetermined grounding point. Provide 1 grounding strip for every 1000 sq. ft. of SDT installed over on-grade concrete. For suspended subfloors, provide one grounding strip for every 500 sq. ft. of tile.
 3. The grounding point connection will be connected by a qualified electrician.

3.3 TILE INSTALLATION

- A. General: Comply with tile manufacturer's installation directions and other requirements indicated that are applicable to each type of tile installation included in Project.
- B. Lay out tiles from center marks established with principal walls so tiles at opposite edges of room are of equal width. Install tiles square with room axis, unless otherwise indicated.
- C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.
1. Lay tiles in decorative pattern as indicated on drawings.
- D. Scribe, cut, and fit tiles to butt tightly to vertical surfaces and edgings.
- E. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, nonstaining marking device.
- G. Install tiles on covers for telephone and electrical ducts, and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on covers. Tightly adhere edges to perimeter of floor around covers and to covers.
- H. Adhere tiles to flooring substrates without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed tile installation.
- I. Use full spread of adhesive applied to substrate in compliance with tile manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times.
- J. Hand roll tiles where required by tile manufacturer.

3.4 INSTALLATION OF WALL BASE AND ACCESSORIES

- A. General: Install resilient accessories according to manufacturer's written installation instructions.
- B. Apply resilient wall base to walls, pilasters, casework, and other permanent fixtures in rooms and areas where base is required. Install wall base in lengths as long as practicable. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - 1. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
 - 2. Install preformed corners as per manufacturer's directions.
- C. Place resilient accessories so they are butted to adjacent materials of type indicated and bond to substrates with adhesive. Install reducer strips at edges of flooring that otherwise would be exposed.

3.5 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing installation:
 - 1. Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturers.
 - 2. Sweep or vacuum floor thoroughly.
 - 3. Do not wash floor until after time period recommended by resilient flooring manufacturer.
 - 4. Damp-mop flooring to remove black marks and soil.
- B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by flooring manufacturer.
 - 1. Apply protective floor polish to flooring surfaces that are free from soil, visible adhesive, and surface blemishes. Coordinate selection of floor polish with Owner's maintenance service requirements.
 - 2. Cover flooring with undyed, untreated building paper until inspection for Substantial Completion.
- C. Clean flooring not more than 4 days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean flooring using method recommended by manufacturer.
 - 1. Strip protective floor polish that was applied after completing installation prior to cleaning.
 - 2. Reapply floor polish after cleaning.

END OF SECTION 09 6500

SECTION 09 6723 - RESINOUS FLOORING

1.1 SUMMARY

A. This Section includes the following:

1. Four-component decorative epoxy flooring system with decorative aggregate and integral base.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product specified. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

1.3 INFORMATIONAL SUBMITTALS

- A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- B. Material Certificates: In lieu of material test reports, when permitted by Architect, signed by manufacturers certifying that materials furnished comply with requirements.
- C. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer (applicator) who has specialized in installing resinous flooring similar in material, design, and extent to that indicated for this Project and who is acceptable to resinous flooring manufacturer.
1. Engage an installer who employs only persons trained and approved by resinous flooring manufacturer for installing resinous flooring systems specified.
 2. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to install resinous flooring systems specified.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, and sealing or finish coats, through one source from a single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

- B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.
- B. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Products: Provide specified materials of Stonhard or equal products of one of the following:
 - 1. Dex-O-Tex.
 - 2. DUR-A-FLEX Inc.

2.2 MATERIALS

- A. VOC Content: Coatings and sealants used for work in this section shall meet the requirements of Section 018113 "Sustainable Design Requirements".
- B. Resinous Flooring: Resinous floor surfacing system consisting of primer; troweled mortar base, body coat(s) including resin, hardener, aggregates, and colorants, if any; decorative broadcast and sealing or finish coat(s). Comply with requirements indicated in this Article.
- C. Substrate Patching and Fill Material: Cementitious product approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- D. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.
- E. Four Component Epoxy Flooring System with Decorative Aggregate Broadcast: Stain-resistant decorative epoxy flooring system with slip-resistant surface. System consists of primer with aggregate broadcast, two-component squeegee applied epoxy undercoat with broadcast decorative aggregate, and clear epoxy sealer topcoat complying with the following:
 - 1. Basis of Design System: Stonshield SLT by Stonhard or equal.
 - 2. Thickness of System: 3mm.
 - 3. Primer: Type recommended. by manufacturer for substrate and application indicated.

4. Aggregate Broadcast: Colored quartz aggregate; Stonshield Aggregate.
5. Undercoat: Two component epoxy undercoat consisting of resin and curing agent; Stonshield Undercoat.
6. Decorative Aggregate Broadcast: Colored quartz aggregate; Stonshield Aggregate.
7. Topcoat: Two-component UV resistant clear epoxy sealer; Stonkote CE4.
8. Texture: Medium.
9. Integral Cove Base: 6" high.
10. Color: As scheduled.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Prepare and clean substrate according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral substrate for resinous flooring application.
- B. Use patching and fill material as required to fill holes and depressions in substrate to provide a flat and even surface for flooring system. Apply patching and fill material according to manufacturer's written instructions.
- C. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 1. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
 2. Verify that concrete substrates are dry. Perform calcium chloride test as per manufacturer's directions, as follows, and other tests if recommended by resinous flooring manufacturer:
 - a. Calcium Chloride Test: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) of slab in 24 hours.
 - b. Perform moisture test at rate of three for the first 1,000 sq. ft. (92.9 sq. m) and one additional test for each 1,000 sq. ft. (92.9 sq. m) of new and existing floor area to be covered unless otherwise recommended by flooring manufacturer.
 3. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
 4. Verify that substrates and conditions are satisfactory for resin floor installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.2 APPLICATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
 - a. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Pre-apply epoxy treatment to substrate cracks as required.
- C. Apply primer over prepared substrate at manufacturer's recommended rate and allow to cure as recommended by manufacturer.
- D. Four Component Epoxy Flooring System with Decorative Aggregate Broadcast: Mix primer, apply to floor and broadcast with Stonshield Aggregate using a special Stonhard Spraycaster while primer is wet. Allow to cure and sweep off excess aggregate. Mix undercoat, apply to floor with squeegee and roll with a medium nap roller. Broadcast Stonshield Aggregate into the freshly rolled undercoat. Allow a minimum of 8 hours to cure. Scrape and sweep the floor to remove all loose aggregate particles, then vacuum. Allow undercoat to cure and remove excess flakes. Mix Stonkote CE4 clear epoxy sealer, apply to floor and allow to cure.
- E. Integral Cove Base: Apply cove base mix to wall surfaces at locations indicated. Round internal and external corners. Install cove base according to manufacturer's written instructions and details including taping, mixing, priming, and topcoating of cove base.

3.3 CLEANING AND PROTECTING

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.
- B. Clean resinous flooring not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each Project area. Use cleaning materials and procedures recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 6723

SECTION 09 7429 - WOOD PANEL WALL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes wood flat panels for installation as a wall system.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product specified
- B. Coordination Drawings: Shop drawings drawn to scale and coordinating penetrations and wall-mounted items. Show the following:
 - 1. Layout of wall panels on wall elevations.
 - 2. Joints between panel units.
 - 3. Panel hanging system member locations.
 - 4. Method of attaching hangers to building structure.
 - 5. Wall-mounted items and equipment.
 - 6. Interface with adjoining materials.
 - 7. Minimum Drawing Scale: 1:100
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on samples of size indicated below.
 - 1. 12-inch- (300-mm-) square samples of each panel type, pattern, and color.
 - 2. Set of 12-inch- (300-mm-) long samples of exposed trim members, including moldings, for each color and system type required.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Indicate compliance of wall panels and components with requirements based on comprehensive testing of current products.
- B. Research/Evaluation Reports: Evidence of panels' and components' compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
- C. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed installations of wood wall panel systems similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Source Limitations: Obtain wood wall panels and attachment components through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wood panels and attachment system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install wood wall panel system until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

- A. Coordinate layout and installation of panels and attachment system with other construction that penetrates walls or is supported by them.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Composite Wood Products: Products shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".
- B. Fire-Test-Response Characteristics: Provide wood wall panels that comply with the following requirements:
 - 1. Surface-Burning Characteristics: Provide panels meeting Class A requirements tested per ASTM E 84.

2.2 WOOD PANELS

- A. Flat Wood Veneer Panel System (WDW-1): Wood veneer panels mounted on concealed aluminum splines with wood trim members, as follows:
 - 1. Wood Panels: Fire-retardant particle board core with face-cut veneers.
 - a. Panel Size: Custom size to match exterior wood composite panels (Prodema)
 - b. Panel Thickness: 3/4" thick
 - c. Panel Perforations: Unperforated (W1)
 - d. Wood Veneer: Natural Variations (real wood) Walnut (NWN)
 - e. Edge Treatment: Panel sides kerfed on all 4 edges.
 - f. Panel Mounting: Spline installation.
 - 2. Fire Rating: Class A
 - 3. NRC: N/A
 - 4. Finish: Factory finish with clear or tinted semigloss coating.
 - 5. Basis of Design Product: Woodworks Standard Wall Panels by Armstrong, or equal.
- B. Mounting System for Flat Veneer Panels: Provide manufacturer's standard aluminum wall spline installation system in color selected by Architect.
- C. Accessories:
 - 1. Provide wood trim members at panel joints, inside and outside corners, and exposed edges in finish to match wall panels.
 - 2. Provide wood base molding in size as selected by Architect, and in finish to match wall panels.
 - 3. Provide all metal installation accessories as required for complete installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which panels attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect wall panel installation and anchorage, and other conditions affecting performance of wall panel system.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Provide wood furring strips as required to secure mounting splines to wall framing, in compliance with manufacturer's installation directions.
- B. Measure each area and establish layout of panels to balance border widths at opposite edges of each wall. Avoid using less-than-half-width panels at borders, and comply with layout shown on approved shop drawings.

3.3 WALL PANEL INSTALLATION

- A. General: Comply with manufacturer's written directions for installing wood wall panel system.
- B. Securely fasten wall spines to substrate. Engage panel kerfed edges into splines.
- C. Install edge moldings and trim to cover reveal joints between panels, and at all panel edges to conceal raw edges.
- D. Install panels with undamaged edges and fitted accurately into splines and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - 1. Arrange directionally patterned panels as indicated on approved shop drawings.

3.4 CLEANING

- A. Clean exposed surfaces of wood wall panels, including trim, edge moldings, and attachment system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 7429

SECTION 09 7750 - FIBER REINFORCED PLASTIC COATED PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes fiberglass reinforced polyester (FRP) panels.

1.2 ACTION SUBMITTALS

- A. Product data for each type of product specified. Include data on physical characteristics, durability, fade resistance, and flame resistance characteristics.
- B. Samples for initial selection purposes of each type and color available for fiber reinforced plastic coated panels and molding accessory required of size indicated below:
 - 1. 3 inch square sample of each fiber reinforced plastic coated panel specified.
 - 2. 6-inch long sample of each molding accessory.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates signed by fiber reinforced plastic coated panel manufacturer certifying materials furnished comply with specified requirements.
- B. Certified test reports showing compliance with requirements for fire performance characteristics and physical properties.
- C. Maintenance data for inclusion in Division 01 Section "Closeout Procedures." Include the following:
 - 1. Methods for maintaining fiber reinforced plastic coated panels.
 - 2. Precautions for use of cleaning materials and methods that could be detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Arrange for installation of fiber reinforced plastic coated panels by a firm that can demonstrate successful experience in installing similar in type and quality to those required for this Project.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect units during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

1.6 PROJECT CONDITIONS

- A. Maintain a constant temperature not less than 70°F in installation areas for at least ten (10) days before and ten (10) days after installation.
- B. Field Measurements: Where units are indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide FRP products as manufactured by Marlite or an approved equivalent by one of the following:
 - 1. Crane Composites, Inc.
 - 2. Parkland Plastics

2.2 FRP PANELS

- A. Performance Requirements:
 - 1. Fire Performance Characteristics: Provide fiber reinforced plastic coated panels with the following surface burning characteristics as determined by testing identical products per ASTM E 84 by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify fiber reinforced plastic coated panels with appropriate markings of applicable testing and inspecting organization.
 - a. Flame Spread: 25 or less.
 - b. Smoke Developed: 450 or less.
- B. FRP Panels: High gloss fiberglass reinforced polyester panels 0.090" thick with smooth textured surface, Class A fire rating, 4-feet wide by height required.
 - 1. Color: As scheduled.
 - 2. Basis of Design Product: "Standard FRP" manufactured by Marlite, or approved equivalent
- C. Accessories: Provide inside corner, outside corner, division molding and edge trim moldings by same manufacturer, matching wall panels.
- D. Adhesives, primers and sealants shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".
- E. Adhesive: Manufacturer's standard low odor, VOC compliant, non-flammable latex based adhesive for use and substrate.

- F. Sealant: Manufacturer's standard clear silicone sealant meeting local VOC requirements.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting installation and performance of fiber reinforced plastic coated panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Acclimate panels to room temperature for 48 hours prior to installation.
- C. Follow manufacturer's printed instructions for surface preparation.

3.3 INSTALLATION

- A. Do not use materials that are unsound, warped, bowed or twisted.
- B. Install fiber reinforced plastic coated panels plumb, level, true, and aligned with adjacent materials.
1. Scribe and cut panels to fit adjoining work.
 2. Install to tolerance of 1/32 inch in 8 feet for plumb and level.
 3. Coordinate with materials and systems that may be in or adjacent to panels. Provide cutouts for mechanical and electrical items that penetrate.
- C. Plan fiber reinforced plastic coated panel layout, balancing panel sizes at corners.
1. Adhere division molding and work from center of wall to corners.
 2. Adhere FRP panels to substrate in accordance with manufacturer's written instructions.
 3. Stagger joints between panels and substrate material.
 4. Provide moldings at all sides of panels. Adhere ceiling line and curb moldings in place with sealant, and provide sealant in molding channels prior to insertion of panels.
 5. Remove excess sealant from panel surfaces immediately.

3.4 ADJUSTING AND CLEANING

- A. Repair damaged or defective fiber reinforced plastic coated panels where possible to eliminate functional or visual defects. Where not possible to repair, replace fiber reinforced plastic coated panels.
- B. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
- C. Use cleaning methods recommended by the fiber reinforced plastic coated panel manufacturer.
- D. Replace panels that cannot be cleaned.

3.5 PROTECTION

- A. Provide final protection and maintain conditions that ensure panels are without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 7750

SECTION 09 9100 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following interior and exterior substrates:
 - 1. Concrete masonry units (CMU).
 - 2. Concrete
 - 3. Steel and iron.
 - 4. Galvanized metal.
 - 5. Gypsum board.
 - 6. Metal decking and framing at ceilings
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples 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: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.3 QUALITY ASSURANCE

- A. MPI Standards: Maintain copy of this standard at the Project site at all times.

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
- B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
 3. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.4 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 (7 deg C).
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.5 PROJECT CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
- C. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Benjamin Moore & Co.
2. PPG Architectural Finishes, Inc.
3. Sherwin-Williams Company (The).
4. Tnemec

2.2 PAINT, GENERAL

A. 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 manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Rust-Preventive Coatings: 100 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Shellacs, Clear: 730 g/L.
9. Shellacs, Pigmented: 550 g/L

C. Low-Emitting Materials: For field applications that are inside the weatherproofing system, paints and coatings shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements."

D. Colors: As scheduled or if not scheduled, as selected by Architect from manufacturer's full range.

1. Colors listed on Finish Schedule are for color matching only.

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 work.

- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry: 12 percent.
 - 3. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that 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 dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- B. Application Procedures: Apply paints and coatings by brush or roller according to the manufacturer's directions, except as noted below. Spray application is not permitted for trim, ceilings and walls, unless specifically approved by Architect in advance for each individual situation. Roller application on woodwork is not permitted.
 - 1. 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.
 - 2. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
 - 3. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
- C. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- D. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- E. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- F. 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.
- G. Painting Mechanical and Electrical 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. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
2. Electrical Work:
 - a. Switchgear.
 - b. Panelboards.
 - c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

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 site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. General: Provide listed products or equal products of other named manufacturers in Part 2.
- B. Steel and Iron Substrates: Polyurethane, Pigmented, Epoxy Zinc Rich Primer and High-Build Epoxy Coating System: Gloss or Semi-Gloss as selected by the Architect.
 - 1. Prime Coat: Epoxy Zinc Rich Primer. Tnemec: Tneme-Zinc Series 90-97 or equal.
 - 2. Intermediate Coat: High-performance, polyamide-epoxy coating; High-Build Epoxy Marine Coating, Low Gloss: Tnemec: Hi-Build Epoxoline, Series 66, tinted slightly lighter than top coat., or equal
 - 3. Topcoat (Gloss)t: Aliphatic Acrylic Polyurethane, Two-Component, Pigmented, Gloss: Tnemec Endura-Shield II Series 1074.
 - 4. Topcoat (Semi-Gloss)t: Aliphatic Acrylic Polyurethane, Two-Component, Pigmented, Semi-Gloss: Tnemec Endura-Shield II Series 1075.
- C. Zinc-Coated (Galvanized) Metal: Full-gloss, acrylic latex enamel finish - 2 coats - self-priming.
 - 1. Prime Coat: Gloss acrylic latex enamel paint; MPI # 114, X-Green 114, 154, X-Green 154, 164, LEED 2009, LEED V4.
 - a. Benjamin Moore Ultra Spec D.T.M. Acrylic Gloss Enamel HP28
 - 2. Top Coat: Gloss acrylic latex enamel paint; MPI # 114, X-Green 114, 154, X-Green 154, 164, LEED 2009, LEED V4.
 - a. Benjamin Moore Ultra Spec D.T.M. Acrylic Gloss Enamel HP28

3.7 INTERIOR PAINTING SCHEDULE

- A. General: Provide listed products or equal products of other named manufacturers in Part 2.
- B. Gypsum Board Ceilings: Flat acrylic finish.
 - 1. Prime Coat: Latex-based, interior primer; MPI # 50, X-Green 50, 149, X-Green 149, LEED 2009, LEED V4, CHPS Certified.
 - a. Benjamin Moore; Ultra Spec 500 Interior Latex Primer N534
 - 2. Intermediate Coat and Topcoat: Factory-formulated flat acrylic latex paint for interior application; MPI # 53, X-Green 53, 143, X-Green 143, LEED 2009, LEED V4, CHPS Certified.
 - a. Benjamin Moore; Ultra Spec 500 Interior Latex Flat N536

- C. Gypsum Drywall Walls: Low-luster (eggshell), acrylic finish.
1. Prime Coat: Latex-based, interior primer; MPI # 50, X-Green 50, 149, X-Green 149, LEED 2009, LEED V4, CHPS Certified.
 - a. Benjamin Moore; Ultra Spec 500 Interior Latex Primer N534
 2. Intermediate Coat and Topcoat: Low-luster (eggshell or satin), acrylic-latex, interior enamel; MPI # 52, X-Green 52, 145, X-Green 145, 139, X-Green 139, LEED 2009 LEED V4, CHPS Certified.
 - a. Benjamin Moore; Ultra Spec 500 Latex Eggshell N538.
- D. Gypsum Drywall Walls at Mechanical Rooms and Janitor's Closets: Semi-Gloss, waterborne acrylic epoxy finish.
1. Prime Coat: Latex or two component epoxy-based, interior primer; MPI # 6, 17, X-Green 17, 39, 137, X-Green 137, LEED Credit, CHPS Certified.
 - a. Benjamin Moore; Fresh Start Multi-Purpose Primer N023.
 2. Intermediate Coat and Topcoat: Two component semi-gloss acrylic-epoxy; Interior/Exterior Epoxy (water based), LEED 2009.
 - a. Benjamin Moore; Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss V341.
- E. Hollow Metal Doors, Frames, and Sidelights, and Ferrous Metals: Semigloss, acrylic-enamel finish.
1. Prime Coat: Rust-Inhibitive Primer (Water Based), MPI #107, X-Green 107, 134, LEED 2009, CHPS Certified.
 - a. Benjamin Moore; Super Spec HP Acrylic Metal Primer P04.
 2. Intermediate Coat and Topcoat: Factory-formulated semigloss acrylic-latex enamel for interior application; MPI # 141, X-Green 141, 153, X-Green 153, LEED 2009, LEED V4.
 - a. Benjamin Moore; Ultra Spec HP D.T.M. Acrylic Semi-Gloss Enamel, HP29
- F. Concrete Masonry Units (CMU): Alkyd, water-based finish; in sheen as selected by Architect.
1. Prime Coat/Block Filler: MPI # 4, X-Green 4, LEED 2009, LEED V4, CHPS Certified.
 - a. Benjamin Moore Super Spec Masonry Interior/Exterior Hi-Build Block Filler 206.
 2. Intermediate Coat and Topcoat: Alkyd, water-based finish; LEED 2009, LEED V4, CHPS Certified. One of the following:
 - a. Satin: Benjamin Moore Advance Waterborne Interior Alkyd Satin 792.
 - b. Semi-Gloss: Benjamin Moore Advance Waterborne Interior Alkyd Semi-Gloss 793.

- c. High Gloss: Benjamin Moore Advance Waterborne Interior Alkyd Gloss 794.
- G. Concrete Masonry Units (CMU) at Mechanical Rooms and Janitor's Closets: Semi-Gloss, waterborne acrylic epoxy finish.
 - 1. Prime Coat: Acrylic block filler primer; LEED 2009.
 - a. Benjamin Moore; Corotech Acrylic Block Filler V114..
 - 2. Intermediate Coat and Topcoat: Two component semi-gloss acrylic-epoxy; Interior/Exterior Epoxy (water based), LEED 2009.
 - a. Benjamin Moore; Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss V341
- H. Metal Decking and Framing Exposed at Ceilings: Flat dryfall finish.
 - 1. Prime Coat: Benjamin Moore; Corotech Prep All Universal Metal Primer V132.
 - 2. Top Coat: Benjamin Moore; Coronado Super Kote 5000 Dry Fall Alkyd Flat 105, MPI # 55.
- I. Concrete Framing and Decking Exposed at Ceilings: Flat dryfall finish.
 - 1. Prime Coat: Type recommended by manufacturer, if required.
 - 2. Top Coat: Benjamin Moore; Coronado Super Kote 5000 Dry Fall Alkyd Flat 105, MPI # 55.

END OF SECTION 09 9100

SECTION 10 1000 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of visual display boards:

1. Magnetic glass marker boards.

1.2 ACTION SUBMITTALS

- A. Product Data: Provide manufacturer's product data for each type of visual display board specified.
- B. Shop Drawings: For each type of visual display board required, including dimensioned elevations. Show location of joints between individual panels where unit dimensions exceed maximum panel length. Include sections of typical trim members. Show anchors, grounds, reinforcement, accessories, layout, and installation details.
- C. Samples for Verification: For each type of visual display unit indicated.
1. Visual Display Panel: Not less than 8-1/2 by 11 inches. Include one panel for each type, color, and texture required.
 2. Accessories: Full-size sample of each type of accessory.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain visual display boards through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Glass Markerboards:
 - a. Krystal
 - b. Quartet.
 - c. Egan Visual
 - d. Clarus Glassboards

2.2 GLASS MARKERBOARD

- A. Magnetic Glass Markerboards: Provide frameless, glass markerboards fabricated from 1/4" thick, fully tempered writing glass, backcoated with color coating, magnetic type. Include all mounting hardware and adhesives as required for each markerboard provided.
 - 1. Color: As selected by Architect from manufacturer's standards.
 - 2. Edges: Eased polished edges and corners.
 - 3. Sizes: As indicated on Drawings.
 - 4. Accessories: Provide marker tray (box tray) in color selected by Architect.
 - 5. Basis of Design Product: Wall2Wall Krystal glass markerboards by Krystal Glass Writing Boards, Inc. or equal.

2.3 MISCELLANEOUS MATERIALS

- A. Mounting Hardware: Manufacturers standard L-Channel and T-Trim pieces as required for securely mounting glass markerboards to wall substrates.
- B. Adhesive: Manufacturer's standard low odor, VOC compliant, non-flammable latex based adhesive for use and substrate.
 - 1. Adhesives shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements".
- C. Adhesive Tape: As recommended by markerboard manufacturer.

2.4 FABRICATION

- A. Assembly: Provide factory-assembled markerboard units in single units without joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine wall surfaces, with Installer present, for compliance with requirements and other conditions affecting installation of visual display boards.
 - 1. Surfaces to receive markerboards shall be free of dirt, scaling paint, and projections or depressions that would affect smooth, finished surfaces of markerboards.
 - 2. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install units in locations and at mounting heights as indicated on drawings; comply with manufacturer's installation instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.

- B. Coordinate Project-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.3 ADJUST AND CLEAN

- A. Verify that accessories required for each unit have been properly installed and that operating units function properly.
- B. Clean units in accordance with the manufacturer's instructions. Break in markerboards only as recommended by the manufacturer.

END OF SECTION 10 1000

SECTION 10 1400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Panel signs.
 - 2. Dimensional letters.
 - 3. Exterior pylon signs.
 - 4. Signage accessories
- B. Comply with the Stony Brook University signage standards, as most recently amended. These standards supercede any specifications contained in this section.

1.2 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.
- B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
 - 1. Provide message list for each sign, including large-scale details of wording, lettering, and braille layout.
 - 2. Provide full-size spacing templates for individually mounted dimensional letters and numbers
- C. Samples for Initial Selection: For each type of sign material indicated that involves color selection.
 - 1. Panel Signs: Samples of each finish type and color, on not less than 4-inch squares of plastic material, showing the full range of colors available
- D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:
 - 1. Panel Signs: Full-size Samples of each type of sign required.
 - 2. Dimensional Letters and Symbols: Provide full-size representative samples of each dimensional letter type and symbol required, showing letter style, color, and material finish and method of attachment
 - 3. Approved samples will be returned for installation into Project.
- E. Delegated Design Submittals: For exterior signs.

1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by signage manufacturer.
- B. Source Limitations: Obtain each sign type through one source from a single manufacturer.
- C. Regulatory Requirements: Comply with ANSI A.117.1 - 2017 and with code provisions as adopted by authorities having jurisdiction.
 1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:
 - a. Room Capacity (for assembly spaces).
 - b. Elevator Signs.
 - c. Stairway Identification.
 - d. Signs for Accessible Spaces.

1.5 COORDINATION

- A. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices and advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 1. Fabricator of Panel Signs:
 - a. Bell Company
 - b. GNS Group

- c. InPro Corp.
 - d. Sign Pro
 - e. CAB Signs
2. Manufacturers of Dimensional Letters and Symbols:
- a. Advance Corporation; Braille-Tac Division.
 - b. A. R. K. Ramos.
 - c. ASI-Modulex, Inc.
 - d. Gemini Incorporated.
 - e. Innerface Sign Systems, Inc.
 - f. Metal Arts; Div. of L&H Mfg. Co.
 - g. Mills Manufacturing Company.
 - h. Mohawk Sign Systems.
 - i. Nelson-Harkins Industries.
 - j. Southwell Company (The).
3. Manufacturers of Pylon Signs:
- a. Vista System
 - b. ASI Sign Systems, Inc.
 - c. Howard Industries

2.2 ALUMINUM

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T6, 6036-T5, 6005-T5 or 6061-T6.
- B. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
- C. Extruded Bars, Shapes and Mouldings: ASTM B 221 (ASTM B 221M), alloy 6063-T6 or 6063-T52.
- D. Castings: ASTM B 26, Almag 35

2.3 STAINLESS STEEL

- A. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness.

2.4 MISCELLANEOUS MATERIALS

- A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing); 0.080 inch (2.03 mm) thick.
 - 1. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five (5) years for application intended. Provide colors indicated on Drawings.

2.5 PANEL SIGNS

- A. General: Provide signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
1. Produce sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally.
 2. Sign materials shall meet a Class A finish.
- B. Photopolymer and Aluminum Panel Signs, Non-Illuminated: Provide lettering, graphics and background materials in custom styles and colors to match those specified on Drawings.
1. Material Composition:
 - a. Photopolymer Components: 0.032 inch (0.8 mm) thick moisture resistant, non-glare interior nylon photopolymer on 0.125 inch thick ultraviolet resistant clear PETG sign base, single piece construction. Laminated photopolymers, added-on characters, and engraved characters are not acceptable.
 - b. Aluminum Components: 0.125 inch thick aluminum sheet with clear brushed finish.
 2. Type and Colors: As specified on Drawings.
 3. Sign Design and Layout: As indicated on Drawings.
 4. Lettering and Braille Content: Provide letters raised 1/32 inch (.79 mm), and grade 2 braille for each specific location. Minimum text height: 5/8 inch (15.8 mm).
 5. Pictograms: Provide graphics raised 1/32 inch (.79 mm), with lettering and braille written description directly below.
 6. Lettering Style: As indicated on Drawings.
 7. Copy Location: As indicated on Drawings.
 8. Corners and Edges: As indicated on Drawings.
 9. Surface Burning Characteristics: Flame spread/smoke developed rating less than 75/120, tested to ASTM E 84 and UL 723.
 10. Rate of Burning: Tested to ASTM D 635 at nominal 0.060 inch thickness with resulting Classification CC1.
 11. Vertical Burning: Tested to UL 94, classified as 94V-2 in thickness of 0.118 inch or greater and 94HB in thicknesses less than 0.118 inch.
 12. Self-Ignition Temperature: 800 degrees F, tested to ASTM D 1929.
 13. Basis of Design Product/Material: Novacryl PT Series Photopolymer, or equal.
 14. Provide specified signage as scheduled.
- C. Mounting Methods:
1. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides; 3M "VHB Heavy Duty Mounting Tape" or equal.

2.6 DIMENSIONAL LETTERS AND SYMBOLS

- A. Cutout Characters: Characters with uniform faces; square-cut, smooth edges; precisely formed lines and profiles. Comply with the following requirements.
 - 1. Material: Sheet or plate stainless.
 - 2. Thickness: 3 inches thick.
 - 3. Finish: #4 directional satin finish
 - 4. Height: 18"
 - 5. Lettering Style: Helvetica Neue Roman 55
 - 6. Mounting: Pin mounted, flush to wall surface.
- B. Anchors and Inserts: Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.7 EXTERIOR PYLON SIGNS

- A. Performance Requirements:
 - 1. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design sign structure and anchorage of pylon signs according to structural performance requirements.
 - 2. Structural Performance: Signs and supporting elements are to withstand the effects of gravity and other loads within limits and under conditions indicated.
 - a. Uniform Wind Load: As indicated on Structural Drawings.
 - 3. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Hollow-Box Sign Frame: Entire perimeter framed with formed-aluminum sheet or extruded-aluminum, hollow-box-type frame with vertical edges attached to supports with aluminum fittings. Close top and bottom edges of panels with manufacturer's standard welded seams or extrusions.,
 - 1. Shape: Rectangular
 - 2. Size: As indicated on Drawings.
 - 3. Solid-Metal Sheet Sign Panels, Returns, and Back: Aluminum sheet, 0.125" thick
 - 4. Acrylic Panel Materials: Acrylic sheet meeting ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering), 0.125" thick.
 - 5. Sign-Panel-Face Finish and Applied Graphics: As indicated on Drawings.
 - a. 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.
 - 6. Photo-Image Graphics: Provided by Owner.
 - 7. Pylon Supports: Internal, concealed.
 - 8. Mounting: On concrete base, using embedded mechanical fasteners.
 - 9. Weeps: Provide weep holes to drain water at lowest part of exterior signs.

- C. Fabrication: Fabricate pylon signs with integral base and frame consisting of channels, angles, plates, or other fittings. Design and fabricate pylon and anchorage to withstand wind pressure indicated for Project location. Detail anchorage so that water can drain out of assembly without obstruction. Drill holes in members for anchor-bolt connection. Provide anchor bolts of size required for connecting base to concrete foundations.
1. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in locations concealed from view after final assembly.
 2. Mill joints to tight, hairline fit. Form joints exposed to weather to resist water penetration and retention.
 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of flux, and dress exposed and contact surfaces.
 4. Conceal fasteners and anchors unless indicated to be exposed; locate exposed fasteners where they will be inconspicuous.
 5. Internal Frames: Manufacturer's standard internal steel framing system and anchorage, modified as required for Project requirements. Provide welded construction. Cut, drill, and tap units to receive hardware, bolts, and similar items. Hot-dip galvanize steel framing system after fabrication according to ASTM A 123/A 123M.
- D. Mounting Methods:
1. Post-Installed Anchors: Fastener systems with stainless steel bolts; 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.
 - a. Uses: Securing signs with imposed loads to structure.
 - b. Material: Alloy Group 1 (A1) (for Type 304) stainless steel bolts, ASTM F593 and nuts, ASTM F594.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that items, including anchor inserts, provided under other sections of Work are sized and located to accommodate signs.
- C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Locate interior wall signs and accessories where indicated, in accordance with ANSI A.117.1 - 2017 and with code provisions as adopted by authorities having jurisdiction, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 - 1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
 - 2. Mount signs on wall adjacent to the latch side of door, unless otherwise indicated. Where there is no wall space to the latch side of the door, including at double leaf doors, mount sign on the nearest adjacent wall as approved by the Architect. Mount signs at 48-inches (1219 mm) from the baseline of the lowest characters to the finished floor.
 - 3. Locate signs to allow approach within 3-inches (75 mm) of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Panel Signs and Directories: Attach signs to wall surfaces using methods indicated below:
 - 1. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
- C. Glass-Mounted Panel Signs: Provide backer panel that matches color and size of panel sign and adhere to glass surface. Mount panel signs to backer panel using self-adhesive methods.
- D. Dimensional Letters and Symbols: Mount letters and symbols using standard fastening methods recommended by the manufacturer for letter form, type of mounting, mounting substrate, and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners
- E. Pylon Signs:
 - 1. Vertical Tolerance: Install pylon signs plumb within a tolerance of 1/16 inch in 3 feet.
 - 2. Attachment with Drilled-in-Place Anchor Bolts: Set pylon base in position over concrete foundation, locate and drill anchor holes, shim and support pylon to prevent movement, place washers and anchor bolts, and tighten. Fill shim space with nonshrink, nonmetallic grout, mixed and placed to comply with manufacturer's written instructions.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

3.4 SIGN SCHEDULE

- A. Provide signage as indicated and scheduled on Drawings.

END OF SECTION 10 1400

SECTION 10 2213 - WIRE MESH PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Standard-duty wire mesh partitions with gates.

1.2 DEFINITIONS

- A. As defined in ASTM E 2016:
 - 1. Intermediate Crimp: Wires pass over one and under the next adjacent wire in both directions, with wires crimped before weaving and with extra crimps between the intersections.
 - 2. Lock Crimp: Deep crimps at points of the intersection that lock wires securely in place

1.3 ACTION SUBMITTALS

- A. Product Data for each type of product specified, consisting of manufacturer's specification, technical data, and installation instructions.
- B. Shop Drawings showing fabrication and installation of wire mesh partitions, including plans, elevations, and large-scale details showing anchorage and accessory items. Provide location template drawings for items supported or anchored to permanent construction
 - 1. Include clearances required for operation of doors and gates.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: 12-by-12-inch (300-by-300-mm) panel constructed of specified frame members and wire mesh. Show method of finishing members at intersections.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage a firm experienced in manufacturing wire mesh partitions similar to those indicated for this Project and that have a record of successful in-service performance.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations for wire mesh products by accurate field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication and delivery schedules with construction progress to avoid delaying the Work.

1.6 COORDINATION

- A. Coordinate installation of anchorages for wire mesh items supported or anchored to permanent construction. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acorn Wire and Iron Works, Inc.
 - 2. G-S Company (The).
 - 3. Newark Wire Works Inc.
 - 4. SpaceGuard Products
 - 5. Wire Crafters Inc.

2.2 MATERIALS

- A. Steel Wire: ASTM A 853.
- B. Steel Channels, Angles, Plates, and Bars: ASTM A 36 (ASTM A 36M).
- C. Cold-Rolled Steel Channels: Formed from steel sheet.
- D. Square Steel Tubing: Cold-formed structural steel tubing, ASTM A 500.

2.3 STANDARD-DUTY MESH PARTITIONS

- A. Mesh: 0.135-inch- (3.4-mm-) diameter, intercrimped steel wire woven into 1-1/2-inch (38-mm) diamond mesh, or 1 by 2 inch rectangular openings securely clinched to frame members.
- B. Frames: Provide cutouts for pipes, ducts, beams, and other items shown or necessary for partition installation. Finish edges of cutouts to provide a neat, protective edge.

1. Vertical Members: 1-1/4-by-5/8-by-0.1046-inch (32-by-16-by-2.7-mm) cold-rolled steel C-Section channels with 1/4-inch- (6-mm-) diameter bolt holes approximately 12 to 18 inches (450 mm) o.c.
 2. Horizontal Members: 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) cold-rolled steel channels, mortised and tenoned to vertical members.
 3. Horizontal Reinforcing Members: 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) cold-rolled steel channels with wire woven through or two 1-by-1/2-inch (25-by-13-mm) steel channels bolted or riveted toe to toe through mesh, and secured to vertical members. Provide number of horizontal reinforcing members to suit panel height as recommended by partition manufacturer.
- C. Vertical Stiffening Bars: For freestanding partitions 12 feet (3.66 m) in height or over, provide flat steel bar stiffener posts between abutting panel frames. Size as recommended by partition manufacturer for partition height required. Increase size of stiffening bars, if required, to maintain partition rigidity.
- D. Top Capping Bars: 2-1/4-by-1-inch (56-by-25-mm) cold-rolled steel channels, secured to top framing channels with 1/4-inch- (6-mm-) diameter "U" bolts spaced not more than 28 inches (700 mm) o.c.
- E. Corner Posts: 1-1/4-by-1-1/4-by-1/8-inch (32-by-32-by-3-mm) steel angles with floor shoe and 1/4-inch- (6-mm-) diameter bolt holes to align with bolt holes in vertical frame members.
- F. Line Posts: Where partition runs exceed 20 feet (6 m) without intersecting or connecting to overhead framing, furnish 3-inch (75-mm) by 4.1-lb (1.9-kg) steel channel line posts with 5-by-18-by-1/4-inch (125-by-450-by-6-mm) steel base plates located at recommended intervals to ensure partition rigidity and stability.
- G. Intersection Posts: Where 3- or 4-way intersections occur, use 1-1/4-by-1-1/4-inch (32-by-32-mm) tubular steel posts with floor shoe and 1/4-inch- (6-mm-) diameter bolt holes aligned for bolting to adjacent panels.
1. For other than 90-degree intersections, use manufacturer's recommended tubular steel corner posts and installation accessories.
- H. Floor Shoes: Cast metal, sized to suit vertical framing and to provide approximately 3 inches (75 mm) of clear space between finished floor and bottom horizontal frame members. Furnish units with set screws for leveling adjustment.

2.4 PARTITION DOORS

- A. Hinged Door: Doorframe of 1-1/4-by-1/2-by-1/8-inch (32-by-13-by-3-mm) steel channels with 1-1/4-by-1/8-inch (32-by-3-mm) flat steel bar cover plates on 3 sides, and 1/8-inch- (3-mm-) thick angle strike bar and cover on lock side. Provide 1-1/2 pairs of 3-by-3-inch

(75-by-75-mm) butt hinges riveted or welded to door and frame. Align bottom of door with bottom of adjacent panels.

1. Cylinder Lock: Mortise type with cylinder specified in Division 08 Section "Door Hardware"; operated by key outside and recessed turn knob inside.

2.5 FABRICATION

- A. Do not use components less than sizes indicated. Use larger-size components as recommended by partition component manufacturer.
- B. Provide bolts, hardware, and accessories for complete installation.
- C. Finish: Provide one of the following, as selected by Architect
 1. Painted Finish: Manufacturer's standard primer, and shop-applied electrostatic spray enamel finish in color selected by Architect.
 2. Galvanized: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - a. ASTM A 123/A 123M, for galvanizing steel and iron components.
 - b. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

PART 3 - EXECUTION

3.1 PARTITION INSTALLATION

- A. Erect partitions plumb, rigid, properly aligned, and securely fastened in place, complying with Drawings and manufacturer's recommendations.
- B. Provide additional field bracing as shown or necessary for rigid, secure installation. Installer to provide additional clips and bracing as required.

3.2 ADJUSTING AND CLEANING

- A. Adjust moving components for smooth operation without binding.
- B. Touch up damaged finish after completing installation using field-applied paint to match color of shop-applied finish.

END OF SECTION 10 2213

SECTION 10 2600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Corner guards.

1.2 ACTION SUBMITTALS

- A. Product Data: Include physical characteristics for each wall and door protection system component indicated.
- B. Samples for initial selection purposes of each type and color available for corner guards required of size indicated below:
1. 6-inch long sample of each type and color of corner guard
- C. Shop Drawings: Show locations, extent, and installation details of each wall and door protection system component. Show methods of attachment to adjoining construction. Show layout of wall panels and proposed reveal locations.

1.3 INFORMATIONAL SUBMITTALS

- A. Certified test reports showing compliance with requirements for fire performance characteristics and physical properties.
- B. Maintenance Data: For each wall and door protection system component to include in maintenance manuals specified in Division 01. Include the following:
1. Precautions for use of cleaning materials and methods that could be detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wall and door protection units through one source from a single manufacturer.
- B. Fire Performance Characteristics: Provide corner guards with the following surface burning characteristics as determined by testing identical products per ASTM E 84 by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction.
1. Flame Spread: 25 or less.
 2. Smoke Developed: 450 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection materials in original undamaged packages and containers inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install wall and door protection components until the space is enclosed and weatherproof and ambient temperature within the building is maintained at not less than 70 deg F (21 deg C) for not less than 72 hours before beginning installation.
- B. Field Measurements: Where units are indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering wall and door protection products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Alpar Architectural Products, LLC
 - 2. Arden Architectural Specialties, Inc
 - 3. Boston Retail Products.
 - 4. Construction Specialties, Inc.
 - 5. IPC Door and Wall Protection Systems; Division of InPro Corporation
 - 6. Pawling Corporation.

2.2 MATERIALS

- A. PVC-free Material: Engineered PETG; Acrovyn 4000 with Shadowgrain texture, or equal.
- B. Aluminum Extrusions: 6063-T6 alloy.
- 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.

2.3 CORNER GUARDS

- A. Surface-Mounted, Engineered PVC-free Corner Guards: Fabricated from engineered PVC-free cover on continuous aluminum retainer; with 90-degree turn to match wall condition.
 - 1. Cover Material: Snap on cover of .078" thickness shall be made from chemical and stain-resistant engineered PVC-free material.
 - a. Wing Size: 3 by 3 inches.
 - b. Texture: Shadowgrain
 - c. Colors: Match adjacent wall paint for each location.
 - 2. Aluminum Retainer: Continuous aluminum retainer of .062" thickness shall be fabricated from 6063-T6 aluminum, with a mill finish.
 - 3. Profile: 1" radius bullnose
 - 4. Height: 48".
 - 5. Wall Offset: 3/8"
 - 6. End Caps: Provide color-matched end caps.
 - 7. Mounting: Mechanical fasteners, of type recommended by manufacturer.
 - 8. Basis of Design Product: Acrovyn SM-10N Corner Guards by Construction Specialties, or equal.

2.4 FABRICATION

- A. General: Fabricate wall and door protection systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including thicknesses of components.
- B. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions in which wall and door protection system components and materials will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection system components.
- B. General: Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. General: Install wall and door protection units 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.
 - 1. Install wall and door protection units in locations and at mounting heights indicated on Drawings.
- B. Do not use materials that are unsound, warped, bowed or twisted.

3.4 ADJUSTING AND CLEANING

- A. Clean installed corner guards. Use cleaning methods recommended by the manufacturer.

3.5 PROTECTION

- A. Provide final protection and maintain conditions that ensure wall and door protection units are without damage or deterioration at time of Substantial Completion.

END OF SECTION 10 2600

SECTION 10 2800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Washroom accessories.
 - 2. Mirrors.
 - 3. Warm air dryers
 - 4. Shower accessories
 - 5. Custodial accessories
 - 6. Installation of Owner furnished washroom accessories

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated on Contract Drawings.
 - 2. Identify products using designations indicated on Contract Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals, including replaceable parts and service recommendations.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.
- B. Inserts and Anchorages: Furnish accessory manufacturer's standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Products: The design for toilet accessories is based on certain named equipment. Subject to compliance with requirements, provide the named product or an equivalent product by one of the following:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Dryer, Inc.
 - 3. American Specialties, Inc.
 - 4. Bradley Corporation.
 - 5. Bobrick Washroom Equipment
 - 6. Excel Dryer Corporation.
 - 7. World Dryer Corporation

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) (22-gage) minimum nominal thickness, unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) (20-gage) minimum nominal thickness.

- C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.3 GRAB BARS

- A. Grab Bars; Stainless Steel Type: Provide grab bars with wall thickness not less than 18 gage, concealed mounting with snap lock covers, satin finish, 1-1/2-inch clearance between wall surface and inside face of bar, outside diameter of 1-1/2 inches; in dimensions and configurations as indicated on Contract Drawings.
 - 1. Basis of Design Products:
 - a. Designation 10C: Bobrick Series B-6806
 - b. Designation 10CS: Bobrick Series B-6861

2.4 SANITARY NAPKIN DISPOSAL UNITS

- A. Surface-Mounted Type (Designation 10G): Fabricate of satin finished stainless steel with seamless 22 gauge cabinet walls and tightly closing top cover with continuous, stainless steel piano hinge.
 - 1. Basis of Design Product: American Specialties Model 0852, or equal.

2.5 WARM-AIR DRYERS

- A. Warm-Air Hand Dryer (Designation 10H): Surface mounted type; infrared optical sensor activation; one piece stainless steel cover; stainless steel wall mounting plate; automatic shutoff after 35 seconds if hands are not removed, motor/blower (5/8 hp / 20,000 rpm) provides air velocity of 19,000lfm at the outlet and 16,000 lfm at the hands. Voltage required: 277 VAC, 9-10 amp, 1500 watt, 60 Hz, single phase; UL/c-UL listed and/or VDE approved and CE marked.
 - 1. Color: Brushed stainless steel cover.
 - 2. Basis of Design Product: XLERATOR Model XL-SB, or approved equivalent.
 - 3. Provide Recess Kit to meet ADA special requirements.

2.6 MIRROR UNITS

- A. Stainless Steel Framed Mirror Units (Designation 10D): Fabricate frame from 18 gauge satin finished stainless steel with corners mitered, welded, and ground smooth. Provide shock absorbing filler 1/8" thick for full size of back, with galvanized steel back, concealed wall hanger and theft-proof fasteners.
1. Sizes: As indicated on Drawings.
 2. Basis of Design Product: American Specialties Inter-Lok Model 0600 or equal.

2.7 HOOKS

- A. Double Robe Hook (Designation 10R): Heavy-duty polished stainless steel double hook with 4" wide curved bar forming hook at each end; rectangular wall bracket with backplate for concealed mounting.
1. Basis of Design Product: Bobrick B-6727, or equivalent

2.8 SHELF

- A. Shelf (Designation 10M): Surface-mounted shelf shall be fabricated of stainless steel with satin finish. Support brackets shall be fabricated from 16.gauge stainless and secured to wall with stainless steel screws. Shelf shall be 18 gauge with 1/2" lip on all 4 sides.
1. Size: 8" d x 24" l
 2. Basis of Design Product: American Specialties Series 0692, or equal.

2.9 SHOWER ACCESSORIES

- A. Shower Curtain Rod (Designation 10K): 1-inch diameter, 20-gage satin-finished stainless steel, with 1-3/8-inch diameter flanges designed for concealed mounting on concealed wall brackets, length as required.
1. Basis of Design Product: Bobrick B-207, or equivalent.
- B. Folding Shower Seat (Designation 10L): Satin stainless steel tubular frame with one-piece seat fabricated from 5/16" thick plastic laminate face with ivory matte melamine finish fused to solid phenolic core. Seat shall fold up against wall when not in use. Spring at top of baseplate shall hold seat in upright position until released by pulling the top of the seat away from the wall.
1. Basis of Design Product: Bobrick B-5191 or equivalent.

2.10 WASHROOM ACCESSORIES FURNISHED BY OWNER, INSTALLED BY CONTRACTOR

- A. Toilet Tissue Dispenser (Designation 10A and 10B): Install Owner-furnished surface-mounted units.
- B. Paper Towel Dispenser (Designation 10F): Install Owner-furnished surface-mounted units.
- C. Soap Dispenser (Designation 10E): Install Owner-furnished surface-mounted units.

2.11 CUSTODIAL ACCESSORIES

- A. Surface-Mounted Utility Shelf with Mop and Broom Holder (Designation 10N): : Fabricate shelf, mop holder and hook support of 18-gage type 304 stainless steel with satin finish, welded construction. Provide unit with stainless steel rag hooks, shelf, and spring loaded rubber cam mop and broom holders with no slip coating; 8-inch deep and 13-inch high with four (4) hooks and three (3) mop holders.

- 1. Basis-of-Design Product: Bobrick B-239, in 34-inch length., or equal.

2.12 FABRICATION

- A. General: No names or labels are permitted on exposed faces of toilet and bath accessory units. On either interior surface not exposed to view or on back surface, provide identification of each accessory item either by a printed, waterproof label or a stamped nameplate indicating manufacturer's name and product number
- B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- C. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.
- D. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six (6) 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.

- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's written instructions for type of substrate involved.
- C. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446, and in compliance with ADA Regulations.

3.2 ADJUSTING AND CLEANING

- A. Adjust toilet accessories for unencumbered, smooth operation. Verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations after removing temporary labels and protective coatings.

END OF SECTION 10 2800

SECTION 10 5200 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Portable fire extinguishers.
 - 2. Fire-protection cabinets for portable fire extinguishers.
 - 3. Fire-protection accessories.

1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
 - 1. Fire Extinguishers: Include rating and classification.
 - 2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."
- C. NYS Fire Code Compliance: Fabricate and label fire extinguishers to comply with New York State Fire Code.
- D. Fire Extinguishers: FM listed and labeled for type, rating, and classification specified.
- E. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. J.L. Industries, Inc.

2. Kidde: Walter Kidde, The Fire Extinguisher Co.
3. Larsen's Manufacturing Company.
4. Potter-Roemer; Div. of Smith Industries, Inc.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.
- B. Stainless-Steel Sheet: ASTM A 666, Type 304.

2.3 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
- B. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, in enameled-steel container.

1. Available Product: MP 10, Larsen's Manufacturing Company.

2.4 FIRE-PROTECTION CABINETS

- A. Basis-of-Design Product: Occult Series Model SS 2409, as manufactured by Larsen's Manufacturing Co., or an approved equivalent product by one of the following:
 1. JL Industries, Inc.
 2. Kidde Fyrnetics.
 3. Potter Roemer; Div. of Smith Industries, Inc.
- B. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
 1. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall where it is installed.
 - a. Construct fire-rated cabinets with double walls fabricated from 0.0478 inch (1.2 mm) thick, cold-rolled steel sheet lined with minimum 5/8 inch (16 mm) thick, fire-barrier material.
 - b. Provide factory-drilled mounting holes.
- C. Cabinet Size: Suitable for specified fire extinguisher.
- D. Cabinet Style: Trimless, with concealed hinge and closed door completely covering cabinet flange.

- E. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
 - 1. Cabinet Material: Enameled-steel sheet.
 - 2. Recessed Cabinet: Cabinet box fully recessed in walls of depth indicated; with box flange overlapping surrounding wall surface and fully concealed by door when in closed position.
- F. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.
 - 1. Door Material: Stainless steel sheet
 - 2. Door Style: Flush, solid panel.
 - 3. Door Hardware: Ensure hardware meets ADA requirements. Provide manufacturer's built-in cylinder lock system (*Larsen-Loc*™), or approved equivalent, and door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.
 - 4. Lettering: Provide factory applied lettering that reads "IN CASE OF FIRE ONLY - PULL FIRMLY ON HANDLE."

2.5 ACCESSORIES

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish. Provide brackets for extinguishers not located in cabinets.
- B. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - a. Location: Applied to cabinet door.
 - b. Application Process: Die cut.
 - c. Lettering Color and Style: As selected by Architect.
 - 2. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.

2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.
- D. Steel Finishes: Manufacturer's standard baked-enamel paint in color selected by Architect for the interior of cabinet.
- E. Stainless Steel, No. 4 finish for door and frame.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for hose valves, hose racks, and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed.
- C. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged units.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing fire-protection specialties.
- B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - 1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
 - 2. Fasten mounting brackets to structure, square and plumb.
 - 3. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust cabinet doors that do not swing or operate freely.
- B. Refinish or replace cabinets and doors damaged during installation.
- C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10 5200

SECTION 10 5213 - AED SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Cabinets for AED unit.

1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for AED specialties.

1. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain AED cabinets through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.

2.2 AED CABINETS

- A. Basis-of-Design Product: 1400 Series AED Cabinet as manufactured by JL Industries, Inc. or an approved equivalent product by one of the following:

1. Allied Medical Products
2. Phillips Healthcare.
3. Physio-Control
4. ZOLL Medical.

- B. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

1. Cabinet Size: Suitable for any size AED unit.
 2. Cabinet Style: Exposed one-piece trim and door frame.
 3. Cabinet Material: Enameled-steel sheet.
 4. Semi-Recessed Cabinet: Semi-recessed cabinet partially concealed in walls, with 2-1/2" or 3" rolled edge trim overlapping wall surface.
- C. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.
1. Door Material: Enameled-steel sheet.
 2. Door Style: Full acrylic or tempered glass glazing with pull handle and AED graphics on door.
- D. Accessories: Provide the following:
1. Audible alarm 85dba, powered by 9 volt battery. Provide with on/off switch
 2. Strobe light, powered by 9 volt battery, built-in to cabinet or mounted above cabinet as required by field conditions.

2.3 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.
- D. Steel Finishes: Manufacturer's standard baked-enamel paint in color selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing AED specialties.

- B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - 1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
 - 2. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust cabinet doors that do not swing or operate freely.
- B. Refinish or replace cabinets and doors damaged during installation.
- C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10 5213

SECTION 11 2429 - ROOF FALL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes design, supply and installation of roof fall protection systems.

1.2 COORDINATION

- A. Coordinate layout and installation of roof fall protection system with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of roof fall protection system component.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof fall protection system.
 - 1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
 - 2. Show complete layout and configuration of fall protection equipment including components and accessories.
 - 3. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
 - 4. Include installation and rigging instructions. Include required restrictive working usage and general safety notes and non-restrictive working usage and general safety notes.
 - 5. Include engineering calculations indicating compliance with requirements signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples: For each type of cable support and railing anchor to be supplied in the system.

1.4 INFORMATIONAL SUBMITTALS

- A. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- B. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

- C. Sample Warranties: For manufacturer's special warranties.
- D. Field reports.
- E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof fall protection system to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed roof fall protection system installations similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: Manufacturer having minimum 10 years experience designing, manufacturing and installing fall protection systems similar in material, design, and extent to that indicated for Project, and capable of providing engineering design and field service representation during construction.
- C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in location of the project and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of roof fall protection systems that are similar to those indicated for this Project in material, design, and extent.
- D. Source Limitations: Obtain all components of roof fall protection system, including cables, tie-offs, anchors, lanyards, railings, railing counterweights, brackets and fittings through one source from a single manufacturer.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original packaging with identification labels intact and in sizes to suit project.
- B. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer

1.8 PROJECT CONDITIONS

- A. Environmental Conditions: Assemble and erect components only when temperatures are above 40 degrees F (4 degrees C)

1.9 WARRANTY

- A. Warranty shall not deprive the Owner of other rights or remedies that the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- B. Provide a manufacturer's warranty covering the material and workmanship for a period of one year from date of final acceptance.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof fall protection system shall withstand exposure to weather and resist thermally induced movement without failure, leaking of roof membrane, or fastener/anchor disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer to design roof fall protection system to comply with performance requirements, including comprehensive engineering analysis using performance requirements and design criteria indicated.
- C. Design Criteria: Comply with Iowa Construction Code and the following:
 - 1. OSHA Regulation 1910, Subpart D, Walking and Working Surfaces
 - 2. OSHA Regulation 1910, Subpart F, Appendix C, Personal Fall Arrest Systems.
 - 3. OSHA Regulation 1910.23 - Guarding Floor and Wall Openings and Holes
 - 4. AISC S342L (including supplement No.1)
 - 5. ANSI/IWCA I-14.1
 - 6. Fall Arrest Safety Anchors:
 - a. Fall arresting force safety factor of 2 to 1 without permanent deformation: 1800 lbs (8.0 kN) minimum.
 - b. Fall arrest force against fracture or detachment: 5,000 lbs (22.4 kN) minimum.
 - 7. Roof Edge Guardrails:
 - a. Handrail, wall rail and guardrail assemblies and attachments shall withstand a minimum concentrated load of 200 pounds (90719 g) applied in any direction on the top rail.
 - b. Infill area of guardrail system capable of withstanding a horizontal concentrated load of 200 pounds (90719 g) applied to one square foot (8165 g/sm) at any point in the system. Load not to act concurrently with loads on top rail of system in determining stress on guardrail.

2.2 ROOF FALL PROTECTION SYSTEM

- A. Basis of Design Manufacturer: Pro-Bel Group of Companies, or equal.
- B. System Components:
 - 1. Anchors: PBE 75-0000 Weld to Structure Roof Anchors
 - 2. Double Lanyard Horizontal Lifeline Systems: HLL-DB-PB Horizontal Lifeline System Assembly – Non Hands-Free – Double Lanyard – Pro-Shock.
 - 3. Other components indicated on Drawings.
- C. Anchors:
 - 1. Safety U-Bars: Stainless steel ASTM A276, Type 304 with 35 Ksi (240 MPa) minimum yield strength; 0.75 inches (19 mm) minimum diameter material with 1.5 inches (38 mm) eye opening.
 - 2. Hollow Steel Section (HSS) Piers: Mild steel, Type 300W with 50 Ksi (350 MPa) minimum yield strength, hot dipped galvanized to ASTM A123/A123M; wall thickness to suit application.
 - 3. Plate and other Sections: Mild steel, Type 300W with 44 Ksi (300 MPa) minimum yield strength, hot dipped galvanized to ASTM A123/A123M; wall thickness to suit application.
 - 4. Miscellaneous Bolts, Nuts and Washers: Stainless steel ASTM A276, Type 304 with 35 Ksi (240 MPa) minimum yield strength.
 - 5. Flashing: As specified in Section 07 6200.
- D. Double Lanyard Horizontal Lifeline Systems:
 - 1. Galvanized steel, 5/16" inches (8mm) minimum diameter cable, 9127 lbs (40 kN) minimum breaking strength with permanently or mechanically swaged cable ends.
 - 2. Data Plate: Ensure non-corrosive data plate stating Maximum Service Capacity of cable, Manufacturer's Name, Serial No., Manufacturing Date, rated load and other pertinent information is prominently displayed at cable system entry points.
 - 3. Tensioner: Stainless steel turnbuckle ASTM A167, Type 316.
 - 4. Harness: Manufacturer's standard full body harness with double shock absorber lanyard. Provide two harnesses and lanyards.
 - 5. In-Line Shock Absorber: Manufacturer's standard product that reduces fall arrest load applied back to the structure
 - 6. Basis of Design Product: Pro-Bel Group, Double Lanyard Horizontal Lifeline System, Non-Hands-Free, or equal.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: 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:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. 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.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant as recommended by roof fall protection system component manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof fall protection system according to manufacturer's written instructions.
1. Install roof fall protection system level; plumb; true to line and elevation.
 2. Anchor roof fall protection system 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 fall protection system and fit them to substrates.
 4. Install roof fall protection system to resist exposure to weather without failing 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..
- C. Seal joints with elastomeric sealant as required by roof fall protection system component manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Engage manufacturer's technical representative to inspect completed system installation and certify it for use, and to verify that it is properly installed as per their written directions.
- B. Submit manufacturer's Certificate for Use upon conclusion of inspection.
- C. Examine, clean, adjust and lubricate moving parts to operate smoothly and fit accurately.

3.4 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. Clean off excess sealants.
- D. Replace roof fall protection system that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 11 2429

SECTION 11 3100 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Range hoods with fire suppression system and fan.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include operating characteristics, dimensions of individual appliances, and finishes for each appliance.
- B. Appliance Schedule: For appliances; use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for each product.
- C. Research/Evaluation Reports: For each product.
- D. Maintenance Data: For each product to include in maintenance manuals.
- E. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain residential appliances through one source.
 - 1. Provide products from same manufacturer for each type of appliance required.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for product's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

- D. Regulatory Requirements: Provide hoods that have the following certifications:
1. ETL tested.
 2. UL300A and UL507 compliance
 3. NSF compliance.
- E. Regulatory Requirements, Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with ANSI A117.1 - 2017 regulations.
1. Operable Parts: Provide controls with forward reach no higher than 48 inches above the floor, horizontal front reach no more than 25 inches, horizontal side reach no more than 24 inches, and that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer of each appliance specified agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
1. Hood: Three years.

PART 2 - PRODUCTS

2.1 APPLIANCES

- A. Range Hoods with Fire Suppression System and Fan: Provide hood with the following attributes
1. Type 304 stainless steel hood
 2. Fully integrated fire suppression system.
 3. Mechanical fail safe actuation
 4. Wall mounted configuration
 5. Top vented ducted.
 6. External wall mounted fan with variable speed motorized impeller
 7. ADA - handicapped accessible fan and light controls for ADA apartments and units.
 8. Electrical disconnect.
 9. Manual pull station with 25 ft. of stainless steel wire rope and three 90 deg. elbows.
 10. Unit Dimensions: 30" long x 19.375" deep x 10.5" deep
 11. Mounting height: 24" minimum, 30" maximum
 12. Weight: 53.4 lbs
 13. Power Requirements:
 - a. 120V, single phase, 60 Hz
 - b. 15-20 amp circuit breaker
 - c. Operating current 1.38 amp

- d. Fan operating current 0.8 amp
 - e. Output operating current 0.25 to 0.5 amp
 - f. Input wiring 12/2 MC wire
 - g. Output wiring 14/2 MC wire
14. Fan Specifications:
- a. CFM (low-high): 208-281
 - b. Pressure (in water): -0.14 - -0.28
 - c. DBA (low-high): 56 - 60
 - d. Hood outlet: 7" diameter
 - e. Duct: 35 ft.
 - f. Fan inlet: 6.5" dia
 - g. Fan outlet: 14 x 3
 - h. Electronic Control Module (ECM)
15. Basis of Design Product: D1000 Series, Model D1030-D-WF-E-ADA-MPK (ADA living areas only) and Model D1030-D-WF-E-MPK (non-ADA living areas) by Denlar Fire Protection or one of the following:
- a. Model GRRS/XRRS by Greenheck / Accurex
 - b. Model WRH by CaptiveAire

2.2 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Color-Coated and Stainless-Steel Finish: Provide appliances with manufacturer's standard finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, color, gloss, and minimum dry film thickness for painted finishes or ground and polished stainless-steel surfaces for uniform, directionally textured finish.

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 work.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
- C. Utilities: Refer to Divisions 22, 23 and 26 for plumbing, HVAC and electrical requirements.

3.3 CLEANING AND PROTECTION

- A. Test each item of residential appliances to verify proper operation. Make necessary adjustments.
- B. Verify that accessories required have been furnished and installed.
- C. Remove packing material from residential appliances and leave units in clean condition, ready for operation.

END OF SECTION 11 3100

SECTION 12 2413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes
 - 1. Manual operation dual black-out and light-filtering shades.
 - 2. Installation of Owner-furnished window shades..

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
- B. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work
- C. Samples for Verification:
 - 1. Shade Material: Not less than 12-inch- (300-mm-) square section of each type of fabric, from dye lot used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of material.
- D. Window Treatment Schedule: Include roller shades in schedule using same room designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of roller shade product, signed by product manufacturer.
- B. Product Test Reports: For each type of roller shade product.
- C. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining roller shades and finishes.
 - 2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
 - 3. Operating hardware.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed installation of roller shades similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance
- B. Source Limitations: Obtain roller shades through one source from a single manufacturer.
- C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Build mockups of in-place full-size window shade unit in the location as directed by Architect.
 - 2. Provide one mock-up for each type of window shade fabric provided in the Work.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete 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 operable glazed units' operation hardware throughout the entire operating range.

1.7 WARRANTY

- A. Manual Roller Shade Hardware: Manufacturer's standard non-depreciating twenty-five year limited warranty.
- B. Standard Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty
- C. EcoVeil Shadecloth: Manufacturer's standard non-depreciating ten year limited warranty

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: Provide specified shade systems by MechoShade System, Inc. or equivalent by one of the following:

1. Draper Shade & Screen Co., Inc.
2. Hunter Douglas Window Fashions.
3. Levolor Contract; a Newell Company; Joanna
4. Silent Gliss USA, Inc

2.2 BASIS OF DESIGN PRODUCTS

- A. Manual Dual-Roller Shades: Provide Classic Mecho/5 Manual System by MechoShade or equal.

2.3 PERFORMANCE CHARACTERISTICS.

- A. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Resistance Ratings: Passes NFPA 701

- B. Sustainability Requirements: Cradle 2 Cradle Bronze, for shadecloth and shade hardware.

2.4 MATERIALS

- A. Glare Control Fabric, 5% Open Mesh Type: 100% thermoplastic olefin (TPO) basket-weave design; "EcoVeil" 1350 Series by MechoShade, or equal.

1. Color: As scheduled.

- B. Room Darkening Fabric, 0-1% Open Type: Tightly woven, sound-absorbing, light-blocking, near-blackout textile, 100% polyester fabric, "AcoustiVeil Dimout" Shadecloth 0890 series by MechoShade, or equal.

1. Color: As selected by Architect.

- C. Brackets: Plated steel, with adequate projection to clear all window fixtures

- D. Aluminum Extrusions: Alloy and temper recommended by manufacturer for use intended and as required for proper application of finish indicated but not less than the strength and durability properties specified in ASTM B 221 for 6063-T5.

2.5 FABRICATION

- A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade
- B. Components: Noncorrosive, self-lubricating materials.
- C. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with manufacturer's standard method for attaching shade material.
- D. Direction of Roll: Regular, from back of roller.
- E. Mounting Brackets:
 - 1. Dual Roll Shades: Galvanized or zinc-plated steel, specially designed for mounting two rollers on a single bracket with fascia.
- F. Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as required for between the jambs mounting; removable design for access
- G. Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation..
- H. Light-Blocking Shade Hardware: Designed for eliminating all visible light gaps when shades are fully closed; manufacturer's standard side channels and perimeter seals, including sill light seal attached to bottom bar, for eliminating light gaps when shades are closed.
 - 1. Provide Exposed LightSeal Hem Bar with soft vinyl welt at bottom in lieu of sill channel for all blackout shades.
 - 2. For dual-shade system, provide for the shade mounted closest to the glass or wall only.
- I. Manual Shade Operation: Bead chain clutch operator.
 - 1. Bead Chain Material: #10 stainless steel chain with 120 lb. breaking strength.
 - 2. Operator Location: On left or right side of shade as directed by Architect for each location.
 - 3. Operator Length: Long chains attached to bottom of mullion.
- J. Shade Units: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch (6 mm) from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
 2. Shade Units Installed Outside Jambs: 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.
- K. Installation Fasteners: Fabricated from metal that is noncorrosive to shade hardware and adjoining construction and to support shades as required by manufacturer's written instructions.
- L. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
- M. Colors of Metal and Plastic Components Exposed to View: As selected by Architect from manufacturer's full range unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow clearances for window operation hardware.
- B. Install metal parts isolated from concrete or mortar to prevent corrosion.
- C. Install mounting brackets with not less than 2 fasteners per bracket.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 SHADE SCHEDULE

- A. Provide new dual-roller shades in Commons.
- B. Install Owner-furnished shades where indicated on Drawings.

END OF SECTION 12 2413

SECTION 12 3661 - SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes manufactured composite stone countertops and window sills.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Each variety of composite stone
 - 2. Stone accessories and other manufactured products.
- B. Shop Drawings: Include plans, sections, details, and attachments to other work.
- C. Samples for Verification: For each composite stone color and pattern indicated, in sets of samples not less than 12 inches (300 mm) square. Include two or more Samples in each set and show the full range of variations in appearance characteristics expected in completed Work.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Sealant Compatibility Test Report: From sealant manufacturer, complying with requirements in Division 07 Section "Joint Sealants" and indicating that sealants will not stain or damage stone.
- C. Maintenance Data: For composite stone countertops to include in maintenance manuals. Include Product Data for stone-care products used or recommended by Installer, and names, addresses, and telephone numbers of local sources for products.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate composite stone countertops similar to that indicated for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.
- C. Source Limitations: Obtain each variety of composite stone from a single manufacturer with resources to provide materials of consistent quality in appearance and physical properties.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store composite stone on wood A-frames or pallets with nonstaining separators and nonstaining, waterproof covers. Ventilate under covers to prevent condensation.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of construction to receive composite stone countertops by field measurements before fabrication

PART 2 - PRODUCTS

2.1 COMPOSITE STONE

- A. Performance Requirements:
 - 1. Composite stone material shall meet the requirements of ASTM E84 for Class A flame spread and smoke developed.
- B. Composite Stone Material: Composite material of natural quartz, polymer resins and pigments.
 - 1. Basis of Design Product: Wilsonart "Quartz"
 - 2. Thickness: 2 cm
 - 3. Color(s): As scheduled.
 - 4. Finish: Polished.

2.2 ADHESIVES, GROUT, SEALANTS, AND STONE ACCESSORIES

- A. General: Use only adhesives formulated for composite stone and recommended by their manufacturer for the application indicated.
 - 1. Adhesives shall have shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements.
- B. Water-Cleanable Epoxy Adhesive: ANSI A118.3.
 - 1. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Laticrete International, Inc.
 - b. MAPEI Corp.
- C. Sealant for Countertops: Manufacturer's standard sealant of characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants" and will not stain the composite stone it is applied to.

1. VOC Content: Sealants and sealant primers shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements
 2. Color: As selected by Architect from manufacturer's full range.
- D. Cleaner: Cleaner specifically formulated for composite stone types, finishes, and applications indicated, as recommended by composite stone producer and, if a sealer is specified, by sealer manufacturer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives..
- E. Countertop Support: Rakks EH Surface Mount Bracket, or equal, in sizes as required for each countertop.
1. Finish: Clear anodized aluminum.

2.3 FABRICATION, GENERAL

- A. Fabricate composite stone countertops in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.
1. Dress joints straight and at right angle to face, unless otherwise indicated.
 2. Cut and drill sinkages and holes in composite stone for anchors, supports, and attachments.
 3. Provide openings, reveals, and similar features as needed to accommodate adjacent work.
 4. Fabricate molded edges with machines having abrasive shaping wheels made to reverse contour of edge profile to produce uniform shape throughout entire length of edge and with precisely formed arris slightly eased to prevent snipping, and matched at joints between units. Form corners of molded edges as indicated with outside corners slightly eased, unless otherwise indicated.
 5. Finish exposed faces of composite stone to comply with requirements indicated for finish of each type of composite stone required and to match approved Samples and mockups. Provide matching finish on exposed edges of countertops, splashes, and cutouts.
- B. Carefully inspect finished composite stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.

2.4 COUNTERTOPS

- A. Nominal Thickness: Provide total thickness indicated.
- B. Edge Detail: Eased.
- C. Joints: Fabricate countertops without joints, to greatest extent possible. Where not possible fabricate countertops in sections for joining in field, with joints at locations indicated and as follows:
1. Sealant-Filled Joints: 1/16 inch (1.5 mm) in width.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates indicated to receive composite stone countertops and conditions under which composite stone countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of composite stone countertops.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Advise installers of other work about specific requirements for placement of inserts and similar items to be used by composite stone countertop Installer for anchoring composite stone countertops. Furnish installers of other work with Drawings or templates showing locations of these items.

3.3 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches (1.5 mm in 1200 mm).
- B. Variation from Level: Do not exceed 1/8 inch in 96 inches (3 mm in 2400 mm), 1/4 inch (6 mm) maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than 1/4 of nominal joint width.
- D. Variation in Plane at Joints (Lipping): Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.
- E. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64-inch (0.4-mm) difference between edges of adjacent units, where edge line continues across joint.

3.4 INSTALLATION OF COUNTERTOPS

- A. General: Install countertops by adhering to supports with water-cleanable epoxy adhesive or mechanically attached to countertop support brackets.
- B. Do not cut composite stone in field, unless otherwise indicated. If composite stone countertops or splashes require additional fabrication not specified to be performed at Project site, return to fabrication shop for adjustment.

- C. Set composite stone to comply with requirements indicated on Drawings and Shop Drawings. Shim and adjust composite stone to locations indicated, with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances. Install anchors and other attachments indicated or necessary to secure composite stone countertops in place.
- D. Bond joints with composite stone adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- E. Apply sealant to joints and gaps specified for filling with sealant; comply with Division 07 Section "Joint Sealants." Remove temporary shims before applying sealant.

3.5 ADJUSTING AND CLEANING

- A. In-Progress Cleaning: Clean countertops as work progresses. Remove adhesive and sealant smears immediately.
- B. Remove and replace composite stone countertops of the following description:
 - 1. Broken, chipped, stained, or otherwise damaged composite stone.
 - 2. Defective countertops.
 - 3. Defective joints, including misaligned joints.
 - 4. Interior composite stone countertops and joints not matching approved Samples and mockups.
 - 5. Interior composite stone countertops not complying with other requirements indicated.
- C. Replace in a manner that results in composite stone countertops matching approved Samples and mockups, complying with other requirements, and showing no evidence of replacement.
- D. Clean composite stone countertops not less than six days after completion of sealant installation, using clean water and soft rags. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage composite stone.

END OF SECTION 12 3661

SECTION 12 4813 - FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Surface-mounted linked-tread-type floor mats and frames.

1.2 ACTION SUBMITTALS

- A. Product data for each type of floor mat and frame specified, including manufacturer's specifications and installation instructions, details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop drawings showing layout and types of floor mat, full-scale sections of typical installations, details of patterns or designs, anchors, and accessories.
- C. Samples for verification purposes in form of 12-inch (300-mm) square assembled section of floor mat and frame members with selected tread surface showing each type of metal finish and color of exposed floor mat, frames, and accessories required. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.3 INFORMATIONAL SUBMITTALS

- A. Maintenance data in the form of manufacturer's printed instructions for cleaning and maintaining floor mats.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain each type of floor mats from one source of a single manufacturer.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Check actual framed openings for mats by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid a delay of the Work

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design and fabricate floor mats and frames to support a uniform distributed load of at least 200 pounds per square foot.
- B. Entrance mats and frames shall have a VOC content in compliance with Section 018113 "Sustainable Design Requirements"

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Construction Specialties, Inc.
 - 2. Mats Inc.
 - 3. Reese Enterprises, Inc.
 - 4. Pawling Corp.

2.3 FRAMES

- A. General: Provide manufacturer's standard design of size and style to fit with mat type; complete with installation anchorages and accessories..
- B. Surface-Mounted Frame: Provide manufacturer's standard tapered vinyl frame 1-1/2" wide, with lead-in edge for surface mounted applications.
 - 1. Color: Black
 - 2. Basis of Design Product: SM Frame by Construction Specialties, Inc. or equal.

2.4 MATS

- A. Surface-Mounted Aluminum Linked-Tread Floor Mat: High-impact vinyl/acrylic tread rails with co-extruded soft-durometer cushions, joined mechanically by aluminum hinge rails; all materials shall be perforated to allow for drainage.
 - 1. Tread Rail Spacing: 2 inches o.c.
 - 2. Mat Depth: 7/16"
 - 3. Aluminum: Extruded aluminum, ASTM B 221, alloy 6063-T6 or 6063-T5
 - 4. Aluminum Finish: Powder coat paint in color as scheduled.
 - 5. Tread Surface: Heavy duty exterior brush type carpet, fabricated from solution dyed polypropylene fibers with 50/50 blend of 600/12-denier multi filament and 595/D1 monofilament, with carpet fiber and monofilament fusion-bonded to a rigid two-ply backing; 32 oz/sq yd carpet weight, in color scheduled
 - a. Basis of Design Product: Construction Specialties designation "EC".
 - 6. Basis of Design Product: "Pedimat M1" by Construction Specialties Inc., or equal.

2.5 FABRICATION

- A. Shop-fabricate units of floor mat work to greatest extent possible in sizes as indicated. Where not indicated otherwise, provide single unit for each mat installation, but do not exceed manufacturer's maximum size recommendation for units intended for removal and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes and note locations on shop drawings. Where possible, verify sizes by field measurement before shop fabrication.
- B. Fabricate frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by means of straight connecting pins.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install surface mounted frames and mats to comply with manufacturer's instructions at locations indicated and with top of frames and mats in relationship to one another and to adjoining finished flooring as recommended by manufacturer. Set mat tops at height for most effective cleaning action and coordinate top of mat surfaces with doors that swing across mats to provide clearance under door.

3.2 PROTECTION

- A. Defer installation of floor mats until time of Substantial Completion for Project.

END OF SECTION 12 4813

SECTION 14 2100 - ELECTRIC TRACTION ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes electric traction passenger/service elevators.
- B. Related Sections include the following:
 - 1. Division 03 Section for setting sleeves, inserts, and anchoring devices in concrete.
 - 2. Division 04 Section for setting sleeves, inserts, and anchoring devices in masonry.
 - 3. Division 05 Sections for the following:
 - a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
 - b. Machine beams.
 - c. Structural-steel shapes for subsills and entrance frames that are part of steel frame.
 - d. Pit ladders.
 - 4. Division 09 Sections for finish flooring in elevator cars.
 - 5. Division 26 Section for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.
 - 6. Division 26 Section for telephone service to elevators.
 - 7. Division 26 Sections for electrical service for elevators to and including fused disconnect switches at machine room door and standby power source, transfer switch, and connection from auxiliary contacts in transfer switch to controller.

1.2 DEFINITIONS

- A. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.3 ACTION SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for the following:
 - 1. Car enclosures and hoistway entrances.
 - 2. Operation, control, and signal systems
- B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure,

relationships with other construction, and locations of equipment and signals. . Include large-scale layout of car control station and standby power operation control panel. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

- C. Samples: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch- (75-mm-) square samples of sheet materials; and 4-inch (100-mm) lengths of running trim members.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, including emergency generator, as shown and specified, are adequate for elevator system being provided.
- B. Maintenance Manuals: Include operation and maintenance instructions, parts listing with sources indicated, recommended parts inventory listing, emergency instructions, and similar information. Include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel. Submit for Owner's information at Project closeout.
- C. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
- D. Qualification Data: For Installer
- E. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or an experienced installer approved by elevator manufacturer who has completed elevator installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Regulatory Requirements: In addition to local governing regulations, comply with applicable provisions in ASME A17.1, "Safety Code for Elevators and Escalators" and Building Code of New York State.
- C. Accessibility Requirements: In addition to local governing regulations, comply with ANSI A117.1-2017.
- D. NFPA: Comply with applicable NFPA codes, and specifically with sections relating to electrical work and elevators.
- E. Fire-Rated Door Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having

jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

- F. Design Criteria: The drawings and specifications indicate the cab clear inside dimensions, motor horsepower and hoistway dimensional requirements and other requirements of the electric traction elevator, and are based on the specific types and models indicated. Electric traction elevators by other manufacturers may be considered, provided deviations in dimensions are minor, and do not change the hoistway dimensions. Motor horsepower must be less than or equal to that specified or the proposer shall pay all costs associated with increasing electrical service to elevator as necessary. The burden of proof of equality is on the proposer.

1.6 COORDINATION

- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

1.7 WARRANTY

- A. Special Manufacturer's Warranty: Written warranty, signed by manufacturer agreeing to repair, restore, or replace defective elevator work within specified warranty period.

- 1. Warranty Period: 12 months from date of Acceptance.

1.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Acceptance, provide 12 months' full maintenance service by skilled employees of the 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. Provide parts and supplies as used in the manufacture and installation of original equipment.
 - 1. Perform maintenance, during normal working hours.
 - 2. Provide emergency 24-hour callback service.
 - a. Response Time: Two hours or less.
- B. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide specified products of Schindler or equivalent elevator manufactured by ThyssenKrupp, KONE or Otis.

2.2 MATERIALS AND COMPONENTS

- A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components, published by manufacturer as included in standard pre-engineered elevator systems and as required for a complete system.
 - 1. Provide machine-room-less type elevator.
- B. Passenger Elevator Machines:
 - 1. Gearless frequency controlled asynchronous machine AC motor with integral drive sheave and normal and emergency brakes. All bearings must be rated for a 20-year life span.
 - 2. Side counterweight configurations shall use a rail mounted design.
- C. Governor:
 - 1. Manual reset from outside hoistway.
 - 2. Mount to structural support channels, concrete machine room slab or guide rail as applicable.
 - 3. Governor rope shall be steel with a diameter of 1/4" (6mm).
- D. Suspension System: Non circular elastomeric coated suspension media with high tensile grade steel cords
- E. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Specification Section.
- F. Guide Rails and Attachments: Guide rails shall be Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual-purpose bracket that combines both counterweight guide rails, and one of the car guide rails to building fastening
- G. Car Frame and Platform: Welded steel units.
- H. Finish Materials: Provide the following materials and finishes for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated:
 - 1. Satin Stainless Steel: ASTM A 666, Type 304, with No. 4, directional satin finish
 - 2. Powder-Coated Steel Sheet: Cold-rolled steel sheet complying with

ASTM A 366/A 366M, matte finish, stretcher-leveled standard of flatness. Provide with factory-applied powder coat paint finish; colors as scheduled.

3. Prime-Painted Steel Sheet: Cold-rolled steel sheet, ASTM A 366/A 366M, or hot-rolled steel sheet, ASTM A 569/A 569M, with factory-applied rust-inhibitive primer.

- I. Firefighters Key: Yale 2642

2.3 OPERATION SYSTEMS

- A. Passenger Elevators: Provide manufacturer's standard microprocessor operation system for each elevator or group of elevators as required to provide type of operation system indicated.

1. Single Elevator: Provide "selective collective automatic operation" as defined in ASME A17.1.

- B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated

1. Loaded-Car Bypass: When car load exceeds a predetermined weight, car will respond only to car calls, not to hall calls. Predetermined weight can be adjusted.
2. Automatic Dispatching of Loaded Car: When car load exceeds a predetermined weight, doors will begin closing.
3. Nuisance Call Cancel: When car calls exceed a preset number while the car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
4. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for overtravel or undertravel. Self-leveling shall, within its zone, be automatic and independent of the operating device. Maintain the car approximately level with the landing irrespective of its load
5. 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 the door close button.
6. Automatic emergency recall and fire fighter's emergency service (Phase I fire service and Phase II car fire service in accordance with ASME A17.1); return to Ground Floor (designated floor), with alternate floor the First Floor.
7. Controls for emergency operation shall be located in each car.
8. Access at bottom landing with zoning.
9. Access at top landing with zoning.

2.4 SIGNAL EQUIPMENT

- A. General: Provide signal equipment for each elevator or group of elevators with hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements of acrylic or other permanent, non-yellowing translucent plastic.

- B. Car Control Stations: Provide manufacturer's standard semirecessed or fully recessed car control stations. Mount in return panel adjacent to car door, if not otherwise indicated.
 - 1. Include call buttons for each landing served and other buttons, switches, and controls required for specified car operation.
 - 2. Mark buttons and switches with manufacturer's standard identification for required use or function that complies with ASME A17.1.
 - 3. Mount controls at heights complying with ANSI A117.1-2017.
- C. Emergency Two-Way Communication System: Provide system that complies with ASME A17.1, BCNYS, and ANSI A117.1-2017. On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Emergency Two-Way Communication System for the Deaf, Hard of Hearing and Speech Impaired: Provide two-way communication system that provides visible text and audible modes that provides the following:
 - 1. When operating in each mode, includes a live interactive system that allows back and forth conversation between the elevator occupants and emergency personnel.
 - 2. Is operational when the elevator is operational.
 - 3. Allows elevator occupants to select the text-based or audible mode depending on their communication needs to interact with emergency personnel.
- E. Car Position Indicator: For passenger elevator cars, provide illuminated-signal type, digital-display type, or segmented type, 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.
 - 1. 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 for each elevator or group of elevators, but not less than one station for each four elevators in a group. For each group of passenger elevators, locate between two elevators at center of group or at location most convenient for approaching passengers.
 - 1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 - 2. Provide units with direction-indicating buttons; two buttons at intermediate landings; one button at terminal landings.
 - 3. Firefighters Phase I key switch shall be located at Ground Floor.
- G. Combination Hall Lanterns/Hall Position Indicators: Provide illuminated-signal type or digital-display type, located above each hoistway entrance. Provide units with illuminated arrows, but provide single arrow at terminal landings.
 - 1. Provide 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.
- 2. With each lantern, provide audible signals indicating car arrival and direction of travel, including floor passing signal.

- H. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations with text and graphics according to ASME A17.1, Figure 2.27.9.
- I. Fireman's Warning Signal (Third Signal): Provide illuminated fireman's hat which shall light in the event a fire is detected in the elevator machine room or hoistway per NFPA 72-6.15.3.9 and ASME A17.1-2.27.3.2.6.
- J. Controllers: Provide contact points in the controllers for fire alarm system interface.
- K. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1, 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.

2.5 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening devices with a uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.
 - 1. Nudging Feature: After car doors are prevented from closing for a predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.6 ELEVATOR MONITORING SYSTEM

- A. Remote Elevator Monitoring: Provide microprocessor controlled system that allows remote monitoring of elevators for maintenance needs and repair requests.

2.7 PASSENGER ELEVATOR CAR ENCLOSURES

- A. General: Provide manufacturer's standard steel-framed car enclosures with nonremovable wall panels as required for wall panel finish specified, suspended ceiling, trim, accessories, access doors, doors, power door operators, sills (thresholds), lighting, and ventilation.
 - 1. Wall Panels: Powder-coat painted steel panels, applied vertically.
 - 2. Car Doors and Frames: Satin finish stainless steel.
 - a. Fabricate car door frame integrally with front wall of car.
 - b. Fabricate car with recesses and cutouts for signal equipment.
 - 3. Luminous Ceiling: Satin finish stainless steel dropped ceiling with downlit round LED lights.
 - 4. Flooring: By others as specified in Division 09 Section "Sheet Carpeting".

5. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6 mm) thickness, mill finish.
 6. Handrails: Round aluminum rails, clear anodized, at sides and rear walls.
 7. Wall Protection Pads: Provide hooks and removable protection pads for interior of cab to completely cover walls, in color selected by Architect.
- B. Emergency Light: Integrated emergency light in a module inclined 20 degrees from vertical, illuminating automatically upon loss of the building's normal power supply.
- C. Top of Car Access: Provide top of car access door complying with ASME/ANSI A17.1.
- D. Car Fan: Provide top of car ventilation fan, one-speed, with key-operated switch in car control station

2.8 PASSENGER HOISTWAY ENTRANCES

- A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.
1. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.
 2. Provide units bearing Underwriters' Laboratories "B" labels.
 3. Comply with elevator manufacturer's requirements for elevator wall interface with hoistway entrance assembly.
- B. Interlocks: Equip each hoistway entrance with an Underwriters' Laboratories "B" label approved type interlock tested as required by code. Design interlock to prevent operation of the car away from the landing until the doors are locked in the closed position as defined by code and prevent opening the doors at any landing from the corridor side unless the car is at rest at that landing or is in the leveling zone and stopping at that landing.
- C. Materials and Fabrication: Provide manufacturer's standards but not less than the following:
1. Stainless-Steel Frames: Formed from stainless steel sheet, with satin finish.
 2. Stainless-Steel Doors: Flush, hollow-metal construction, fabricated from stainless steel with satin finish.
 3. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6 mm) thickness, mill finish.
 4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

2.9 SIGNAGE

- A. Provide signage complying with Safety Code for Elevators and Escalators (ASME A17.1), ANSI A117.1-2017, and the Building Code of New York State.

2.10 PASSENGER/SERVICE ELEVATORS

A. Elevator No. 1

1. Type: One front opening gearless traction elevator
2. Basis of Design Product: Schindler 3300.
3. Rated Load: 3500 lb.
4. Rated Speed: 100 fpm.
5. Operation System: Simplex operation, microprocessor control.
6. Power Characteristics: 208V, 3 phase, 60 Hz.
7. Horsepower: 30 HP
8. Number of Stops: 4
9. Auxiliary Operations:
 - a. Loaded-car bypass.
 - b. Automatic dispatching of loaded car.
 - c. Nuisance call cancel.
 - d. Access at top landing with zoning.
 - e. Access at bottom landing with zoning.
 - f. Earthquake Emergency Operation: Comply with requirements in ASME A17.1.
 - g. Automatic emergency recall and fire fighter's emergency service (Phase I fire service and Phase II car fire service in accordance with ASME A17.1); return to Ground Floor (designated floor), with alternate floor the Second Floor.
 - h. Options: Provide all optional features specified or as required for code compliance.
 - i. Elevator shall be tied into building emergency power system.
10. Car Enclosures: As follows:
 - a. Inside Width: 6' - 9-5/16"
 - b. Inside Depth: 5' - 6-3/16"
 - c. Inside Height: 7' - 9" (clear height under ceiling 7' - 7-3/8").
 - d. Front Walls: Satin stainless steel with integral car door frames.
 - e. Car Fixtures: Satin stainless steel.
 - f. Car Walls: Powder-coated paint finish on steel panels.
 - 1) Color: Memphis Gray
 - g. Door Faces (Interior): Satin stainless steel.
 - h. Door Sills: Aluminum.
 - i. Ceiling: Satin finish dropped stainless steel ceiling with round downlit LED lights.
 - j. Handrails: Clear anodized aluminum round bar, at sides and rear walls.
 - k. Floor: By others as specified in Division 09 Section "Sheet Carpeting"
 - l. Ventilation: Fan.
11. Hoistway Entrances: As follows:

- a. Width: 3'-6"
 - b. Height: 7'-0"
 - c. Door Type: Two-speed side opening, right hand door
 - d. Frames: Stainless steel.
 - e. Doors: Stainless steel.
 - f. Sills: Aluminum.
12. Hall Fixtures: Satin stainless steel
13. Additional Requirements: As follows:
- a. Provide inspection certificate in each car, mounted under acrylic cover with satin stainless-steel frame.
 - b. Provide protective blanket hooks on cab front and walls and one set of vinyl full-height protection pads in color selected by Architect.
 - c. Provide inspection switch and car top inspection station.
 - d. Provide university standard fire service key Yale 2642, unless otherwise directed by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed. Proceed with installation only after unsatisfactory conditions have been corrected.
1. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions.
1. Install hoistway frames according to NFPA 80
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to minimize transmission of vibrations to structure and thereby minimize structure-borne noise from elevator system.
- D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. 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.
- F. Leveling Tolerance: 1/8 inch (3 mm), up or down, regardless of load and direction of travel.
- G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and governing regulations and agencies. All tests shall be witnessed by a qualified elevator inspector (QEI) retained by the Owner.
- B. Operating Test: Load elevators to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of elevator machines during 30-minute test period. Record failure of elevators to perform as required.
 - 1. Perform operating test specified above on one elevator of each type, capacity, speed, and travel distance.
- C. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

3.4 DEMONSTRATION

- A. Instruct Owner's personnel in proper use, operation, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies. Train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with Owner on requirements for a complete elevator maintenance program.
- B. Make a final check of each elevator operation with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

3.5 PROTECTION

- A. Temporary Use: Do not use elevators for construction purposes unless cars are provided with temporary enclosures, either within finished cars or in place of finished cars, to protect finishes from damage.

1. Provide full maintenance service by skilled, competent employees of elevator Installer for elevators used for construction purposes. Include 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. Use same parts and supplies as used in the manufacture and installation of original equipment.
2. Provide protective coverings, barriers, devices, signs, and other procedures to protect elevators. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. 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. Provide services of an elevator operator to operate the elevator during construction for construction purposes once temporary enclosures are in place. Cost of operator's services shall be borne by Contractor.

END OF SECTION 14 2100