HARNETT REGIONAL JETPORT
NEW TERMINAL BUILDING
WBS NO. 36237.25.15.1
615 AIRPORT RD
ERWIN, NC 28229

PROJECT MANUAL – VOLUME B
SEPTEMBER 9, 2022

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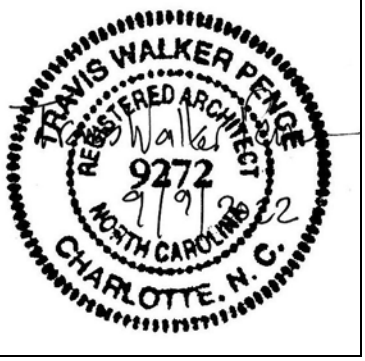
ARCHITECT	**Travis Walker Pence, AIA** **NC #9272** For Specifications Sections accompanied by "The Wilson Group" in the header area of the document and not otherwise prepared by other design professionals of record.	

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1.2 SPECIFICATIONS ARE PROVIDED ON THE RESPECTIVE ENGINEERING DRAWINGS FOR PLUMBING, HVAC, ELECTRICAL, AND FIRE DETECTION WORK.

END OF DOCUMENT 000107

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VOLUME A

* Denotes specifications that are not organized under CSI MasterFormat.

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SECTION 024116 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of buildings.
2. Removing below-grade construction.
3. Disconnecting, capping or sealing, and removing site utilities.
4. Salvaging items for reuse by Owner.

1.2 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Engineering Survey: Submit engineering survey of condition of building.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection and for dust control. Indicate proposed locations and construction of barriers.

C. Schedule of building demolition activities with starting and ending dates for each activity.

D. Predemolition photographs or video.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.5 CLOSEOUT SUBMITTALS

A. Inventory of items that have been removed and salvaged.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.7 FIELD CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

E. On-site storage or sale of removed items or materials is not permitted.

F. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

C. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

B. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.

1. Owner will arrange to shut off utilities when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
4. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
5. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.

D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION

A. General: Demolish indicated buildings completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.

2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

C. Explosives: Use of explosives is not permitted.

D. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

E. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

F. Salvage: Items to be removed and salvaged are indicated below:

1. <**Insert items to be salvaged**>.

G. Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet outside footprint indicated for new construction.

1. Remove below-grade construction, including basements, foundation walls, and footings, completely.

H. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet outside footprint indicated for new construction. Abandon utilities outside this area.

I. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 312000 "Earth Moving."

J. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

K. Promptly repair damage to adjacent buildings caused by demolition operations.

3.6 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

B. Do not burn demolished materials.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

END OF SECTION 024116

SECTION 030522 - CRYSTALLINE WATERPROOFING ADMIXTURE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Crystalline waterproofing concrete admixtures.

B. Related Sections:
   1. Section 033000 "Cast-In-Place Concrete"

1.2 REFERENCES

A. American Concrete Institute (ACI).
   1. ACI 305R-10 - Guide to Hot Weather Concreting.
   2. ACI 306R-10 - Guide to Cold Weather Concreting.
   3. ACI 308.1-11 - Specification for Curing Concrete.

B. American Society of the International Association for Testing and Materials (ASTM).
   1. ASTM C39/C39M-16 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C. British Standard Institution.
   1. BS EN 12390-8:2009 - Testing Hardened Concrete: Depth of Penetration of Water Under Pressure.

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer’s product data for specified products.

1.4 INFORMATIONAL SUBMITTALS

A. Quality Assurance Submittals:
   1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
   2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
   3. Manufacturer’s Instructions: Manufacturer’s application instructions.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Manufacturer to have no less than 10 years experience in manufacturing crystalline waterproofing additive.
2. Manufacturer must be capable of providing field service representation during construction phase.
    a. Manufacturers who cannot provide ongoing field support or who cannot provide the performance test data specified herein will not be considered for the project.

B. Installer Qualifications: Installers must have received training from the Manufacturer and be an Approved Applicator of the manufacturer.

1.6 COORDINATION

A. Coordinate and schedule addition of concrete admixture with concrete batching.

1.7 DELIVERY, STORAGE AND HANDLING

A. Comply with product delivery requirements under General Conditions of the Contract Documents and manufacturer's instructions.

B. Delivery: Materials shall be delivered in original sealed containers, clearly marked with brand name and type of materials.

C. Storage: Store in dry, cool conditions. Unlimited shelf life if stored according to manufacturer's

D. instruction in unopened containers and protected from moisture.

1.8 WARRANTY

A. Warranty: Provide manufacturer's standard warranty.
    1. Warranty Period: 20 Years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Permeability: When tested to BS EN 12390-8 at 0.5 MPa for 72 hours, permeability of treated concrete will be reduced by 80% over untreated concrete.

B. Compressive Strength: Treated concrete must have compressive strength equal or higher than plain concrete when tested to ASTM C39/C39M at 28 days.

C. Drying Shrinkage: Minimum 10% reduced drying shrinkage for treated concrete when tested to ASTM C157.

D. Self-Sealing: Autogenous crack sealing of treated concrete for cracks with width of 0.02 inches.

E. Corrosion of Reinforcing Steel: Waterproofing admixture shall provide enhanced corrosion resistance to embedded steel such that no noticeable signs of corrosion shall be evident after 10 years exposure to corrosive environment.

F. Compatibility:
   1. Admixture shall be compatible with other concrete admixtures such as plasticizers, accelerators and air entrainers.
   2. Admixture shall not affect adhesion to concrete and shall be compatible with adhesives specified for floor coverings.

2.2 WATERPROOFING ADMIXTURE

A. Waterproofing Admixture: Provide concrete concentrate admixture which has been manufactured to be added to concrete mix at time of concrete batching.
   1. Basis of Design: Subject to compliance with requirements, provide basis of design indicated or approved equal.
      a. Alchemco; TechCrete Admix (Basis of Design)
      b. Or approved equal.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Comply with manufacturer's written installation instructions and standard installation procedures.

B. Coordinate waterproofing work with work of other trades. Provide materials and accessories in timely manner so as not to delay the Work.

C. Crack Control: All reinforcement and concretes shall be in accordance with applicable standards for structural concrete to minimize cracking.

D. Setting Time and Strength: Waterproofing admixture may retard setting times and may result in an increase in compressive strength. The amount of set time will depend on numerous factors including weather, mix design, dosage rate of the admix, and the effect of other admixes on the setting time. Care must be taken when adding admixtures such as water-reducers or plasticizers that may retard the setting time as that could result in a combined effect of several products retarding the set.
   1. Conduct a trial mix under project conditions to determine the setting time and strength of the concrete.

E. Weather: Extremes of weather will affect the mixing, cartage and placement of concrete. Concrete placement being carried out in very high or low temperatures, follow practices such as ACI 305R (Hot Weather Concreting) and ACI 306R (Cold Weather Concreting).

3.2 APPLICATION

A. Mixing: Admixture shall be added to the concrete at the batch plant at the rate as recommended by manufacturer.

B. Construction Joints/Expansion Joints/Penetrations: All joints and penetrations must be sealed with an appropriate waterstop recommended by manufacturer.

C. Concrete Vibration: Properly vibrate and compact concrete to avoid honeycombing.

D. Curing: Moist cure concrete using mist spray or sprinkler for up to 7 days in accordance with ACI 308.
   1. Alternative Curing: Curing compounds, complying with ASTM C-309, may be used.

E. Defective Concrete: Concrete defects shall be repaired in accordance with manufacturer's recommendations and industry standards. All areas of honeycombing shall be repaired.

3.3 FIELD QUALITY CONTROL

A. Arrange for manufacturer’s representative to inspect the preparatory Work prior to placement of concrete and to observe the placement of concrete.

B. In addition to the field quality control specified in Section 033000 "Cast-in-Place Concrete," engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

END OF SECTION 030522

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for formwork related to concrete pavement and walks.

1.3 DEFINITIONS

A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.

B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction, movement, contraction, and isolation joints
c. Forms and form-removal limitations.
d. Anchor rod and anchorage device installation tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Exposed surface form-facing material.

2. Concealed surface form-facing material.
3. Form ties.
4. Waterstops.
5. Form-release agent.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing and inspection agency.

B. Research Reports: For insulating concrete forms indicating compliance with International Code Council Acceptance Criteria AC353.

C. Field quality-control reports.

D. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: An independent agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

B. Design, engineer, erect, shore, brace, and maintain insulating concrete forms in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design cross ties to transfer the effects of the following loads to the cast-in-place concrete core:

a. Wind Loads: As indicated on Drawings.

1) Horizontal Deflection Limit: Not more than 1/240 of the wall height.

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:

a. Plywood, metal, or other approved panel materials.
b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

1) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
2) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 WATERSTOPS

A. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

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

a. Adeka Corporation.
b. CETCO, a Minerals Technologies company.
c. GCP Applied Technologies Inc.
d. Sika Corporation.

2.4 RELATED MATERIALS

A. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034-inch- thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
2. Form release agent for form liners shall be acceptable to form liner manufacturer.

F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301.

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.

C. Limit concrete surface irregularities as follows:

1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.

1. Minimize joints.
2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.

1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

1. Provide and secure units to support screed strips
2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.

1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
2. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.

1. Determine sizes and locations from trades providing such items.
2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:

1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement.
4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.

    a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings.

    a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.

1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
5. Clean embedded items immediately prior to concrete placement.

3.3 INSTALLATION OF WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.

1. Install in longest lengths practicable.
2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
3. Protect exposed waterstops during progress of the Work.

3.4 REMOVING AND REUSING FORMS

A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work.

1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.

2. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.

1. Align and secure joints to avoid offsets.
2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.5 FIELD QUALITY CONTROL

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

B. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

B. Related Requirements:
1. Section 321313 "Concrete Paving" for reinforcing related to concrete pavement and walks.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction contraction and isolation joints.
c. Steel-reinforcement installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.
3. Mechanical splice couplers.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M

B. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:

a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

2. Mechanical splice couplers.

C. Field quality-control reports.

D. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

C. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.

D. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

C. Mechanical Splice Couplers: ACI 318 Type 1, same material of reinforcing bar being spliced; tension-compression type.

D. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.

1. Finish: Plain.

2.3 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.
3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

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

B. Inspections:

1. Steel-reinforcement placement.
2. Steel-reinforcement mechanical splice couplers.
3. Steel-reinforcement welding.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.
4. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with fly ash.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete Subcontractor.

2. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction joints, control joints, isolation joints, and joint-filler strips.
c. Vapor-retarder installation.
d. Anchor rod and anchorage device installation tolerances.
e. Cold and hot weather concreting procedures.
f. Concrete finishes and finishing.
g. Curing procedures.
h. Forms and form-removal limitations.
i. Methods for achieving specified floor and slab flatness and levelness.
j. Floor and slab flatness and levelness measurements.
k. Concrete repair procedures.
l. Concrete protection.
m. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
n. Protection of field cured field test cylinders.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures:

    a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

5. Vapor retarders.
6. Floor and slab treatments.
7. Curing materials.
8. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
10. Intended placement method.
11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

a. Location of construction joints is subject to approval of the Engineer of Record.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Floor and slab treatments.
5. Bonding agents.
6. Adhesives.
7. Vapor retarders.
8. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Aggregates.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

E. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

F. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician.

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Regional Materials: Concrete shall be manufactured within 100 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

B. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

C. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II, gray.
2. Fly Ash: ASTM C618, Class C or F.

D. Normal-Weight Aggregates: ASTM C33/C33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.

2. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

E. Lightweight Aggregate: ASTM C330/C330M, 3/4-inch nominal maximum aggregate size.

F. Air-Entraining Admixture: ASTM C260/C260M.

G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

H. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

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

a. Barrier-Bac; Inteplast Group.
b. ISI Building Products.
c. Poly-America, L.P.
d. Reef Industries, Inc.
e. Stego Industries, LLC.
f. Tex-Trude.
g. W.R. Meadows, Inc.

2. Products 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."

2.4 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

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

a. BASF Corporation.
b. Bon Tool Co.
c. ChemMasters, Inc.
d. Dayton Superior.
e. Euclid Chemical Company (The); an RPM company.
f. Kaufman Products, Inc.
g. Lambert Corporation.
h. Laticrete International, Inc.

i. Metalcrete Industries.
j. Nox-Crete Products Group.
k. Sika Corporation.
l. SpecChem, LLC.
m. TK Products.
n. Vexcon Chemicals Inc.
o. W.R. Meadows, Inc.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F: Black.
b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
c. Ambient Temperature Above 85 deg F: White.

C. Water: Potable or complying with ASTM C1602/C1602M.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.6 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4,100 psi at 28 days when tested in accordance with ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5,000 psi at 28 days when tested in accordance with ASTM C109/C109M.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 20 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for parking structure slabs, and concrete with a w/cm below 0.50.

2.8 CONCRETE MIXTURES

A. See drawings for design mix information

1. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by the Engineer of Record.
2. Place joints perpendicular to main reinforcement.

a. Continue reinforcement across construction joints unless otherwise indicated.
b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Engineer of Record and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer of Record in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    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 mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

    a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
    b. Remove projections larger than 1 inch.
    c. Tie holes do not require patching.
    d. Surface Tolerance: ACI 117 Class D.
    e. Apply to concrete surfaces not exposed to public view.

2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

    a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    b. Remove projections larger than 1/4 inch.
    c. Patch tie holes.
    d. Surface Tolerance: ACI 117 Class B.
    e. Locations: Apply to concrete surfaces as indicated.

3. ACI 301 Surface Finish SF-3.0:

    a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    b. Remove projections larger than 1/8 inch.
    c. Patch tie holes.
    d. Surface Tolerance: ACI 117 Class A.
    e. Locations: Apply to concrete surfaces as indicated.

B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:

1. Smooth-Rubbed Finish:

    a. Perform no later than one day after form removal.
    b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
    c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
    d. Maintain required patterns or variances as shown on Drawings or to match field sample panels.

2. Grout-Cleaned Rubbed Finish:

a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
b. Do not clean concrete surfaces as Work progresses.
c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
d. Wet concrete surfaces.
e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
f. Maintain required patterns or variances as shown on Drawings or to match field sample panels.

3. Cork-Floated Finish:

a. Mix 1 part portland cement to 1 part fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint.
b. Mix 1 part portland cement and 1 part fine sand with sufficient water to produce a mixture of stiff grout. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
c. Wet concrete surfaces.
d. Compress grout into voids by grinding surface.
e. In a swirling motion, finish surface with a cork float.
f. Maintain required patterns or variances as shown on Drawings or to match field sample panels.

4. Scrubbed Finish: After concrete has achieved a compressive strength of from 1,000 to 1,500 psi, apply scrubbed finish.

a. Wet concrete surfaces thoroughly and scrub with stiff fiber or wire brushes, using water freely, until top mortar surface is removed and aggregate is uniformly exposed.
b. Rinse scrubbed surfaces with clean water.
c. Maintain continuity of finish on each surface or area of Work.
d. Remove only enough concrete mortar from surfaces to match field sample panels.

C. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
3. Apply scratch finish to surfaces to receive concrete floor toppings and to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

    a. Slabs on Ground:

        1) Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 24; and of levelness, F_L 17.

    b. Suspended Slabs:

        1) Specified overall values of flatness, F_F 35; and of levelness, F_L 20; with minimum local values of flatness, F_F 24; and of levelness, F_L 15. Levelness requirements may be waived for slabs on metal deck.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: As indicated herein.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.

    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.

1. Cast-in inserts and accessories, as shown on Drawings.
2. Screed, tamp, and trowel finish concrete surfaces.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

    1) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

        a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
        b) Cure for not less than seven days.

3.11 TOLERANCES

A. Conform to ACI 117.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month.
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

    a. Limit cut depth to 3/4 inch.
    b. Make edges of cuts perpendicular to concrete surface.
    c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
    d. Fill and compact with patching mortar before bonding agent has dried.
    e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to remain exposed with repair topping.

    a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
    b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

    a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    d. Place, compact, and finish to blend with adjacent finished concrete.
    e. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

    a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
    b. Dampen cleaned concrete surfaces and apply bonding agent.
    c. Place patching mortar before bonding agent has dried.
    d. Compact patching mortar and finish to match adjacent concrete.
    e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.

2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results.
        13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

    a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; ASTM C173/C173M volumetric method, for structural lightweight concrete.

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:

    a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

5. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

6. Compression Test Specimens: ASTM C31/C31M:

    a. Cast and laboratory cure two sets of four 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C39/C39M.

    a. Test one set of two laboratory-cured specimens at seven days and three sets of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5,000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5,000 psi.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests:

    a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed byEngineer of Record.

b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed byEngineer of Record.

1) Acceptance criteria for concrete strength shall be in accordance with ACI 301, section 1.6.6.3.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 24 hours of completion of floor finishing and promptly report test results to Architect.

3.15 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 033503 – WATER VAPOR EMISSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes concrete sealers for the remediation of excessive moisture in concrete slabs.

1.3 SYSTEM DESCRIPTION

A. Provide liquid penetrant concrete sealer and cementitious underlayment to mechanically and chemically reduce water vapor emission and alkalinity from concrete slab to levels acceptable to manufacturer of finish floor covering and adhesive. Work includes preconstruction testing, preparation of slab, application of sealant, and field quality control.

1.4 PERFORMANCE REQUIREMENTS

A. Provide concrete sealer to remediate excessive moisture in floor slab so that moisture-vapor-emission will not exceed 3 lb of water/1000 sq. ft. in 24 hours.

B. Material Compatibility: Provide vapor emission control system materials that are compatible with one another and finish flooring adhesives under conditions of service and application required, as demonstrated by system manufacturer based on testing and long-term field experience.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.

B. Qualification Data for Installer and Testing Agency.

C. Field Quality Control Test Reports.

D. Special Warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer that employs workers trained and approved by manufacturer to apply sealers.

B. Testing Agency Qualifications: An independent testing agency, acceptable to manufacturer, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

C. Manufacturer Qualifications:
1. Minimum 5 years of producing moisture vapor control emission products.
2. Minimum 5 years of product application experience.
3. Employs factory-trained representatives who are available for consultation and Project-site inspection.

4. Warranty program covering costs associated with repair or replacement of concrete vapor emission control system and finish floor covering or coating, including repair or replacement labor.
5. Warranty program covering costs for both system materials and system installation for prescribed vapor emission control system treatment.

D. Source Limitations: Obtain concrete sealers through one source from a single manufacturer. Product shall be acceptable to manufacturer of finish flooring and adhesive.

E. Inform manufacturer’s technical representative of all concrete additives used in the concrete mix or preparation of the slab.

F. Test area: Shot blast a test area, as designated by Architect, to evaluate the surface condition and verify that treated area will be acceptable to installer of finish flooring.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.

B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

1.8 PROJECT CONDITIONS

A. Environmental Limitations for Sealers: Comply with manufacturer’s recommendations for ambient temperature, humidity and condition of slab.

B. Allow for continuous ventilation and indirect air movement at all times during application and curing process of the water vapor reduction system.

1.9 WARRANTY

A. The manufacturer warrants that when applied according to manufacturer’s written recommendations on properly prepared concrete slab as accepted by manufacturer’s technical representative the water vapor reduction system will reduce water vapor emissions by 80 percent as indicated by testing by independent testing agency.
   1. Warranty shall not exclude non-conformance to ACI 318, foreign salts, admixtures, resin and silicate surface treatments or cohesive failure in the concrete surface due to normal concrete movement.

B. Special Warranty: Manufacturer's standard form in which manufacturer warrants water vapor reduction system against defects in material and workmanship within the specified warranty period. Manufacturer agrees to replace floor coverings that fail within specified warranty period due to excessive water vapor emissions through concrete slab. Failures include, but are not limited to, the following:
   1. Adhesives.
   2. Delamination or adhesive failure of floor covering systems, including epoxy and polyurethane resinous flooring systems.

C. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE SEALERS

A. Sealer: Penetrating sealer recommended by manufacturer for application to interior concrete traffic surfaces for the reduction of excess water vapor emissions from concrete slabs.

B. Products: Subject to compliance with requirements, provide one of the following:
   1. Koester American Corporation. www.koesterusa.com.
      a. VAP 1-2000 for application to green concrete.
      b. VAP 1 pH for application to cured concrete
   2. Terasco
   3. Aquafin

C. Topcoat: Sealing or finish coats.
   1. Resin: Epoxy or urethane.
   2. Type: Clear.
   3. Finish: Matte.
   4. Number of Coats: Two.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer and manufacturer's technical representative present, for compliance with requirements for condition of the concrete slab and other conditions affecting performance of water vapor reduction system.
   1. Manufacturer's technical representative shall identify number and location of test sites.
   2. Perform testing on freshly abraded concrete.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Moisture Testing: Anhydrous calcium chloride test, ASTM F 1869.
   1. Maintain temperature and humidity levels expected during normal occupancy or 65 to 85 degrees F and 40 to 60 percent relative humidity for 48 hours before performing test.

D. Testing for alkalinity and contaminant: Perform tests recommended by manufacturer's technical representative.

E. Submit results to Architect and manufacturer's technical representative.

3.2 PREPARATION

A. Shot blast concrete slabs and remove all residue and loose material from slab.

B. Repair defects, cracks, and open surface honeycombs.

C. Clean concrete as recommended by manufacturer to remove dirt, oils, films, and other materials detrimental to sealer application.

D. Remove reinforcing fibers from surface.

E. Protect adjacent construction from overspray or splashing of sealer.

3.3 APPLICATION

A. General: Comply with manufacturer's written instructions and recommendations for application of products, including surface preparation.

B. Concrete Sealer: Apply by brush, roller, or airless spray at manufacturer's recommended application rate.

C. Topcoat: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

D. Protect sealed concrete slab to prevent damage from active rain or topical water for a period of time recommended by manufacturer.

3.4 FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Report findings to Architect and manufacturer's technical representative.

C. Reapply sealer, if required, to meet performance requirements.

END OF SECTION 033503

SECTION 033533 – STAMPED CONCRETE FINISHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Stamped concrete.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

1.3 REFERENCES

A. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

B. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 12 inches (305 mm) square representing actual product, color, and patterns.

E. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

F. Applicator's Project References: Submit applicator's list of successfully completed stamped concrete projects, including project name and location, name of architect, and type and quantity of materials applied.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.

B. Installer Qualifications: Minimum 2 year experience installing similar products.

1. Regularly engaged, for preceding 5 years, in application of stamped concrete of similar type to that specified.

2. Employ persons trained for application of stamped concrete.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Construct Mock-ups of Stamped Concrete:

a. Use same materials and methods for use in the Work.

b. Location: Determined by Architect.

c. Minimum Size: 4 feet by 4 feet (1219 mm by 1219 mm).

2. Receive approval of mock-ups by Architect for patterns, colors, textures, finishing, curing, cleaning, sealing, special effects, and workmanship before application of stamped concrete.

3. Approved Mock-ups:

a. Standard for patterns, colors, textures, finishing, curing, sealing, special effects, and workmanship of stamped concrete.

b. Retain through completion of Work for use as quality standard.

1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

1. Require attendance of parties directly affecting work of this section, including:

a. Contractor.

b. Architect.

c. Landscape architect.

d. Applicator.

e. Manufacturer's representative.

2. Review:

a. Mock-ups.

b. Materials.

c. Preparation.

d. Application.

e. Finishing.

f. Curing.

g. Cleaning.

h. Sealing.

i. Protection.

j. Coordination with other work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:

1. Store and handle materials in accordance with manufacturer's instructions.

2. Keep materials in manufacturer's original, unopened containers and packaging until application.

3. Store materials in clean, dry area indoors.

4. Store materials out of direct sunlight.

5. Keep materials from freezing.

6. Protect materials during storage, handling, and application to prevent contamination or damage.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

B. Apply materials when air and surface temperatures are between 55 degrees F (13 degrees C) and 80 degrees F (27 degrees C).

C. Do not apply materials when rain, snow, or excessive moisture is expected during application or within 24 hours after application.

1.9 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Solomon Colors, which is located at: 4050 Color Plant Rd.; Springfield, IL 62702-1060; Toll Free Tel: 800-624-0261; Tel: 217-522-3112; Fax: 800-624-3147; Email:request info (sgs@solomoncolors.com); Web:www.solomoncolors.com.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Concrete Topping and Hardener: Brickform "Color Hardener".

1. Color: Architect to select from Manufacturer’s full range.

a. Application Rate: Minimum pounds per 100 square feet per manufacturer’s requirements.

B. Liquid Integral Concrete Color: Brickform "Liquid Color".

1. Compliance: ASTM C 979.

2. Color: Architect to select from Manufacturer’s full range.

C. Colorless Bond Breaker: Brickform "Liquid Release".

D. Stamping Mats: Brickform "Creative Image Mats".

1. Pattern: Architect to select from Manufacturer’s full range.

E. Curing Compound:

1. Clear, non-yellowing, non-staining, breathable, UV stable.

2. Compliance: ASTM C 309.

3. Compatible with colored concrete.

F. Concrete Cleaner: Brickform "Antique Release/Efflorescence Remover".

1. Biodegradable.

G. Sealer: High-Gloss Sealer: Brickform "Gem-Seal".

1. Wet-look, UV-resistant, lacquer-based, acrylic, clear sealer.

2. VOC: 100 g/L.

3. VOC: 400 g/L.

4. VOC: 650 g/L.

H. Sealer: High-Sheen Sealer: Brickform "Poly-Seal".

1. Wet-look, UV-resistant, lacquer-based, acrylic, clear sealer.

2. VOC: 650 g/L.

I. Sealer: Low-Sheen Sealer with Traction Grip: Brickform "Safety-Seal".

1. Slip-resistant, UV-resistant, lacquer-based, acrylic, clear sealer.

2. VOC: 100 g/L.

3. VOC: 400 g/L.

4. VOC: 650 g/L.

J. Sealer: Satin-Finish Sealer: Brickform "Satin-Seal".

1. Natural-look, water-based, acrylic, clear sealer.

2. VOC: 100 g/L.

K. Sealer: High-Solids, High-Build Sealer: Brickform "Poly-Astic".

1. Wet-look, UV-resistant, high-build, Polyaspartic, clear sealer.

2. VOC: 0 g/L.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive stamped concrete.

B. Notify Architect of conditions that would adversely affect application or subsequent use.

C. Do not begin preparation or application until unacceptable conditions are corrected.

3.2 PREPARATION

A. Protection of In-Place Conditions: Protect adjacent surfaces, areas, adjoining walls, and landscaping from contact with stamped concrete materials.

B. Preparation of Subgrade:

1. Ensure subgrade is uniformly graded, compacted, and moistened.

2. Ensure subgrade is free of standing water.

3. Do not place concrete over soft, frozen, or muddy subgrade.

C. Concrete:

1. Specified in Section 03 30 00 - Cast-in-Place Concrete, unless otherwise specified in this section.

2. Cement Content: See Section 03 30 00.

3. Slump: Maximum 4 inches.

4. Calcium Chloride: Do not use calcium chloride or admixtures containing calcium chloride.

5. Fine and Course Aggregates:

a. Non-reactive.

b. Free of deleterious material.

3.3 APPLICATION

A. Apply stamped concrete materials in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Concrete Topping and Hardener:

1. Apply concrete topping and hardener in accordance with manufacturer's instructions.

2. Apply concrete topping and hardener to give complete and uniform coverage to concrete.

3. Ensure uniform color results.

C. Integrally Colored Concrete: Design mix, batch, add colorant, place, finish, and cure concrete in accordance with integral concrete color manufacturer's instructions.

D. Colored Bond Breaker/Antiquing Release Agent: Release and imprint concrete with colored bond breaker/antiquing release agent in accordance with manufacturer's instructions.

E. Colorless Bond Breaker:

1. Apply colorless bond breaker in accordance with manufacturer's instructions to bottom of stamping mats and on concrete surface, when concrete has reached plastic stage desirable for imprinting.

2. Do not trowel or mix colorless bond breaker into plastic concrete surface.

F. Stamping Mats:

1. Press stamping mats in accordance with manufacturer's instructions into concrete that has reached plastic stage desirable for imprinting.

2. Use stamping mats to create patterns in concrete as indicated on the Drawings.

G. Approved Mock-ups: Match approved mock-ups for patterns, colors, textures, finishing, curing, cleaning, sealing, special effects, and workmanship.

3.4 CURING

A. Cure concrete in accordance with manufacturer's instructions.

B. Apply curing compound in accordance with manufacturer's instructions.

C. Do not cure concrete using materials or methods harmful to concrete surface, including:

1. Low-pressure or high-pressure steam.

2. Burlap.

3. Plastic sheeting.

4. Membrane paper.

5. Water misting.

6. Sodium-silicone-type hardeners.

3.5 CLEANING

A. Clean concrete in accordance with manufacturer's instructions.

B. Apply concrete cleaner in accordance with manufacturer's instructions to remove:

1. Excess colored bond breaker/antiquing release agent.

2. Efflorescence.

3. Cement scale.

C. Apply concrete cleaner before sealing concrete surface.

3.6 SEALING

A. Seal concrete surfaces in accordance with manufacturer's instructions.

B. Apply sealer to clean and dry concrete surfaces in accordance with manufacturer's instructions after concrete has cured a minimum of 28 days.

C. Apply sealer uniformly over entire stamped concrete surface.

D. Do not allow traffic on finished sealed surfaces for the following periods after application:

1. Foot Traffic: Minimum 24 hours.

2. Heavy Traffic: Minimum 72 hours.

3.7 PROTECTION

A. Interior Surfaces: Protect applied stamped concrete from damage during construction.

B. Exterior Surfaces: Protect applied stamped concrete to ensure that, except for normal weathering, concrete will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 034500 – POLYMER MODIFIED GLASS REINFORCED CONCRETE

PART 1 - GENERAL

1.1 SCOPE:

A. Furnish all labor, materials, equipment and services necessary orincidental to completion of molded glass fiber reinforced concrete composites (G.F.R.C.) and associated work in accordance with the contract documents and all applicable building codes.

1.2 WORK INCLUDED:

A. Manufacturer to provide all labor, materials, equipment and related services required for the fabrication of G.F.R.C. shapes shown in the contract documents.

B. Installer to provide all labor, materials, equipment and related services required for complete erection of the G.F.R.C. and joint treatment if required.

1.3 SUBMITTALS:

A. Samples: Submit three (3) 6” x 6’’ flat samples for paint and finish section.

B. Submit shop drawings for approval showing plans, sections, details, joint treatment, reinforcing fastening devices and relation to adjacent construction as required.

C. Manufacturer to provide one full size mock-up (Architect to specify piece) to the jobsite for installation and review.

1.4 WARRANTY

A. Manufacturer will warrant all materials against defect for one (1) year after acceptance of materials.

B. Installer will warrant installation of installed materials for one (1) year after acceptance of materials.

C. The manufacturer will, at his discretion, repair or replace defective pieces subject to approval of architect.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate Finish Glass Fiber Reinforced Concrete (G.F.R.C.) to be fabricated using long strand continuous glass fiber mats laminated with polymer modified Portland Cement.

B. Embeds and reinforcement (if required by manufacturer) to be galvanized steel or wood. GC to coordinate shop drawings with manufacturer's requirements for all support framing, indicating framing members, sizes, spacing, attachment, and joint details for review prior to installation.

C. G.F.R.C. members to be stored in climate-controlled conditions for sufficient period of time to ensure product stability before being shipped.

D. All G.F.R.C. members to have identification marks, as indicated on shop drawings, clearly displayed on backside of part.

E. Miscellaneous Materials:
1. All other materials, i.e. screws, clips, adhesives, shims, hanger wire, etc., to be per manufacturers shop drawings and/or job specifications and shall be supplied by installer of G.F.R.C. materials.

2.2 MANUFACTURERS

A. Casting Designs, Inc. 9320 Crowley Road Fort Worth, TX 76134-5903 Phone: (800) 329-7373.

B. Formglas Products Ltd. – Tel: 416-635-8030 Contact your local representative: Tom Rochester – tomr@seas-tr.com

C. Moonlight Molds, 310-538-9142 14920 S San Pedro St. Gardena, CA 90248

2.3 SUBSTITUTIONS

A. Manufacturers desiring consideration other than those specified must submit data, samples and certified testing reports showing compliance to all guidelines set forth in the G.F.R.C. specification ten days prior to bid date. Before being considered, manufacturers must: Have five years experience in manufacturing G.F.R.C., provide photographs, copies of certified tests, shop drawings, names and contact for architects and installing contractors of at least three projects. Projects must be of similar scope.

2.4 PHYSICAL PROPERTIES

A. Glass Fiber = 5-6% by weight

B. Shell Thickness = 3/8" nominal

C. Weight = 4 lbs./ft.

D. Density = 115.7 lbs./ft. 3

E. Finish = Smooth

F. Tensile Strength = 1110 psi. (ASTM C947)

G. Flexural Strength = 2590 psi. (ASTM C947)

H. Compressive Strength = 9520 psi. (ASTM C472)

I. Impact Strength = 12.51 ft lbs./in. (ASTM D256)

2.5 TOLERANCES

A. Dimension – all directions +- 3/16''

B. Thickness 3/8" +- 1/8"

C. Warpage or bowing 1/16" per foot

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling:
1. All G.F.R.C. material shipped to be placed in specially built crates and shipped in a manner that will protect pieces from damage, dirt, moisture and warpage.
2. Support pieces during shipment on non-staining shock absorbing materials.
3. Lift and support pieces only at points indicated for attachment on drawings.

B. Specifier's Option: Any limitations regarding crate size weight or jobsite unloading facilities should be noted in this section.

3.2 STORAGE

A. Once uncrated, material to be stored in an upright position on a flat, smooth and level surface. Avoid stacking and leaning of pieces as much as possible.

B. Cover and protect pieces from excessive dirt, moisture, surface damage or other jobsite hazards.

3.3 INSPECTION

A. Contractor shall be responsible for inspecting job conditions and providing lines, centers, grades and marks in sufficient detail for correct installation.

B. Installer will verify all marks and check jobsite conditions for clearance, working space and all marks provided before commencement of installation. Installer will also inspect all pieces prior to installation. Installer will be responsible for repairing all installed pieces except manufacturing defects. All discrepancies affecting the installation of the G.F.R.C. members will be brought to the attention of the General Contractor and resolved before installation begins.

C. General Contractor to provide sufficient space for unloading and transport of pieces as required.

3.4 ERECTION

A. Safety: Installer is responsible for handling and installing the G.F.R.C. material in a safe manner. Report any unsafe conditions immediately to the General Contractor.

B. Installer will use experienced workmen to install the G.F.R.C. pieces. Material will be installed level and plumb and as shown in the approved shop drawings. All pieces will be securely anchored and joints finished as shown in the approved shop drawings.

C. The installer will protect the G.F.R.C. members from damage by other trades during construction and until accepted by the General Contractor.

D. After erection and acceptance of finished pieces, all damage and repair will be the responsibility of the General Contractor.

3.5 TAPING, PATCHING AND CONTROL JOINTS

A. Exterior tape and bed joints are to be attached with an exterior grade construction adhesive. Then taped and floated using fiberglass mesh tape and a bedding compound of Portland Cement, boding agent, water fine washed silica sand (sand omitted in finish coats) and clean the joint to match piece surface and shape/

B. Countersunk fasteners and damage are to be patched using same bedding compound as used to float joints.

C. Control joints or exposed joints to be filled with appropriate backer rod and a sealant (Dow Corning 795 or Soneborn NP-1 or equally capable of withstanding +- 25% joint movement.

3.6 FINISHING

A. See Painting/Coating Section of Specifications. G.F.R.C. is shipped as a Natural Portland/Gray color. Field finishing is required and should be treated as a masonry/concrete product. Architect to select finished color from manufacturer’s full range. GC to submit sample colors to Architect for review.

END OF SECTION 034500

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Pre-faced concrete masonry units.
3. Clay face brick.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

C. Samples for Verification: For each type and color of exposed masonry unit and colored mortar.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product. For masonry units, include data on material properties.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.5 QUALITY ASSURANCE

A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches long by 48 inches high by full thickness.

1.6 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

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

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.

C. CMUs: ASTM C 90.

1. Density Classification: Normal weight.

D. Pre-faced CMUs: Lightweight hollow concrete units complying with ASTM C 90, with manufacturer's standard smooth resinous facing complying with ASTM C 744.
1. Size: Manufactured with pre-faced surfaces having 1/16-inch-wide returns of facing to create 1/4-inch-wide mortar joints.
2. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C 216 or hollow brick complying with ASTM C 652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area).
1. Grade: MW or SW.
2. Type: FBX FBS FBA or HBX HBS HBA.
3. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.
4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
5. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing according to ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet.
6. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C 91/C 91M.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.

F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

2. Colored Masonry Cement:

G. Aggregate for Mortar: ASTM C 144.

1. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
2. White-Mortar Aggregates: Natural white sand or crushed white stone.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Aggregate for Grout: ASTM C 404.

I. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for glazed or pre-faced masonry units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

J. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

K. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

L. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.187-inch diameter.
4. Wire Size for Cross Rods: 0.187-inch diameter.
5. Wire Size for Veneer Ties: 0.187-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.

D. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus two side rods at each wythe of masonry 4 inches wide or less.
2. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch cover on outside face.
3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

E. Masonry-Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch-diameter, hot-dip galvanized carbon-steel continuous wire.

2.6 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Wire: Fabricate from 1/4-inch- diameter, hot-dip galvanized-steel wire.

D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized-steel wire.
2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- diameter, hot-dip galvanized-steel wire.

E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.105-inch-thick steel sheet, galvanized after fabrication
2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- diameter, hot-dip galvanized-steel wire.

3. Corrugated-Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.105-inch-thick steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete.

F. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

H. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.105-inch-thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.25-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section.

5. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a gasketed sheet metal anchor section, with pronged legs of length to match thickness of insulation or sheathing and raised rib-stiffened strap to provide a slot for inserting wire tie.

6. Seismic Masonry-Veneer Anchors: Connector section and rib-stiffened, sheet metal anchor section with screw holes top and bottom, and having slotted holes for inserting connector section. Connector section consists of a rib-stiffened, sheet metal bent plate, sheet metal clip, or wire tie with rigid PVC extrusion designed to engage continuous wire.

7. Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except with hex washer head and neoprene or EPDM washer, No. 10 diameter, and with coating with salt-spray resistance to red rust of more than 800 hours according to ASTM B 117.

2.7 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with Section 076200 "Sheet Metal Flashing and Trim" and as follows:

1. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
2. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.

3. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.

B. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

D. Weep/Cavity Vent Products: Use one of the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.

3. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Configuration: Provide one of the following:

a. Strips, full depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.
b. Strips, not less than 3/4 inch thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
c. Sheets or strips full depth of cavity and installed to full height of cavity.
d. Sheets or strips not less than 3/4 inch thick and installed to full height of cavity, with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from clogging with mortar.

2.9 MASONRY-CELL FILL

A. Loose-Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).

B. Lightweight-Aggregate Fill: ASTM C 331/C 331M.

2.10 MASONRY CLEANERS

A. 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.

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.
2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime or masonry cement mortar.
4. For reinforced masonry, use portland cement-lime or masonry cement mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type S or Type N.
4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
5. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.

3. Mix to match Architect's sample.
4. Application: Use pigmented mortar for exposed mortar joints with the following units:
   a. Pre-faced CMUs.
   b. Clay face brick.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.
2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:
   a. Pre-faced CMUs.
   b. Clay face brick.

F. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

G. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

1. Application: Use epoxy pointing mortar for exposed mortar joints with the following units:

   a. Pre-faced CMUs.
   b. Glazed structural clay facing tile.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

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.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

E. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid masonry units and hollow brick with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Lay structural clay tile as follows:

1. Lay vertical-cell units with full head joints unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
2. Lay horizontal-cell units with full bed joints unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.
3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch-thick joints.

D. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 COMPOSITE MASONRY

A. Bond wythes of composite masonry together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.

B. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

C. Collar Joints in Clay Tile Masonry: After each course is laid, fill the vertical, longitudinal joint between wythes solidly with mortar at exterior walls, except cavity walls, and interior walls and partitions.

D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.

E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide individual metal ties not more than 16 inches o.c.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.
c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Parge cavity face of backup wythe in a single coat approximately 3/8 inch thick. Trowel face of parge coat smooth.

D. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for

this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

3.7 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached and seismic anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed connector sections and continuous wire in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.

3.8 MASONRY-CELL FILL

A. Pour loose-fill insulation into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than 20 feet.

3.9 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.10 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

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

3.11 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:
1. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
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 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 back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.

C. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.
3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

E. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form cavity vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.12 REINFORCED UNIT MASONRY INSTALLATION

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

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

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

H. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.14 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.15 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. 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.
3. Protect adjacent surfaces from contact with cleaner.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.16 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches of finished grade.

B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 044313.16 - ADHERED STONE MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stone masonry adhered to wood framing and sheathing.

B. Related Requirements:

   1. Section 042000 "Unit Masonry" for concealed flashing.
   2. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles for stone masonry.

1.2 ACTION SUBMITTALS

A. Product Data: For each variety of stone, stone accessory, and manufactured product.

B. Samples:

   1. For each stone type indicated.
   2. For each color of mortar required.

1.3 FIELD CONDITIONS

A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work.

B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried.

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

PART 2 - PRODUCTS

2.1 CULTURED STONE

   1. Basis-of-Design Product: As indicated on Finish Schedule.

2.2 MORTAR MATERIALS

A. Masonry Cement: ASTM C 91.

B. Colored Masonry Cement Mix: Packaged blend of masonry cement and mortar pigments. Mix shall produce color indicated or, if not indicated, as selected from manufacturer's standard colors. Pigments shall not exceed 5 percent of masonry cement by weight.

C. Aggregate: ASTM C 144 and as follows:

1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
2. White Aggregates: Natural white sand or ground white stone.
3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

D. Water: Potable.

2.3 MISCELLANEOUS MASONRY ACCESSORIES

A. Expanded Metal Lath: 3.4 lb/sq. yd., self-furring, diamond-mesh lath complying with ASTM C 847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G60.

B. Welded-Wire Lath: ASTM C 933, fabricated into 2-by-2-inch mesh with minimum 0.0625-inch- diameter, galvanized-steel wire.

2.4 MORTAR MIXES

A. General: Do not use admixtures unless otherwise indicated.

1. Do not use calcium chloride.
2. Use masonry cement mortar unless otherwise indicated.
3. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches required consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.

B. Mortar for Stone Masonry: Comply with ASTM C 270, Proportion Specification.

PART 3 - EXECUTION

3.1 SETTING OF STONE MASONRY, GENERAL

A. Perform necessary field cutting and trimming as stone is set.

1. Use power saws to cut stone that is fabricated with saw-cut surfaces.

2. Use hammer and chisel to split stone that is fabricated with split surfaces.
3. Pitch face at field-split edges as needed to match stones that are not field split.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

C. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

D. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 3/8 inch at narrowest points or more than 1/2 inch at widest points.

E. Provide sealant joints of widths and at locations indicated.

1. Keep sealant joints free of mortar and other rigid materials.
2. Sealing joints is specified in Section 079200 "Joint Sealants."

3.2 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.

3.3 INSTALLATION OF ADHERED STONE MASONRY VENEER

1. Install per Manufacturer’s Written Installation Instructions.

3.4 ADJUSTING AND CLEANING

A. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone 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 cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.
6. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.5 EXCESS MATERIALS AND WASTE

A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.

B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches of finished grade.

END OF SECTION 044313.16

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shrinkage-resistant grout.

B. Related Requirements:
1. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
2. Section 099600 "High-Performance Coatings" for painting requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

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

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.
5. Shop primer.
6. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

C. Delegated-Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural-steel materials, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shear stud connectors.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: The Fabricator must meet at least one of the two following requirements.

1. A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
2. A qualified fabricator with a minimum of 5 years' experience in fabricating structural steel similar to that indicated for this project and with a record of successful in-service

performance, as well as sufficient production capacity to fabricate structural steel without delaying the work. The fabricator shall retain, at no cost to the owner, a structural engineer to oversee an inspection process as directed by the Engineer of Record. The structural engineer shall submit a summary letter and all supporting documentation to the Engineer of Record for approval. The letter shall be signed and sealed by an engineering licensed in the state where the project is located, and must be approved by the Engineer of Record prior to fabrication.

B. Installer Qualifications: The Installer must meet at least one of the two following requirements.

1. A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
2. A qualified and experienced installer who has completed structural steel work similar in material, design, and extent to that indicated for the project, and with a record of successful in-service performance for a minimum of 5 years.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1.9 DELIVERY, STORAGE, AND HANDLING

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

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

1. Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.

    a. Use Load and Resistance Factor Design; data are given at factored-load level.

C. Moment Connections: Type FR, fully restrained.

D. Construction: As indicated.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M, and ASTM A572/A572M, Grade 50 as indicated.

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

1. Weight Class: Standard, or as indicated.
2. Finish: Black except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36.

1. Configuration: Straight.
2. Nuts: ASTM A563 heavy-hex carbon steel.
3. Plate Washers: ASTM A36/A36M carbon steel.
4. Washers: ASTM F436, Type 1, hardened carbon steel.
5. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

2.5 PRIMER

A. Steel Primer:

1. Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer: MPI#134.

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: ASTM A780/A780M.

2.6 SHRINKAGE-RESISTANT GROUT

A. Non-metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, non-metallic aggregate grout, non-corrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize items as indicated on the Drawings.

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
1. SSPC-SP 3.

C. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Base Plates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1) Liquid Penetrant Inspection: ASTM E165/E165M.
2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3) Ultrasonic Inspection: ASTM E164.
4) Radiographic Inspection: ASTM E94/E94M.

3.6 PROTECTION

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

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 3 power-tool cleaning.

C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Composite floor deck.

B. Related Requirements:

   1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
   2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

   1. Power-actuated mechanical fasteners.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

C. Recycled Content of Steel Products: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

2.2 COMPOSITE FLOOR DECK

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

1. Canam Steel Corporation; Canam Group, Inc.
2. Cordeck.
3. DACS, Inc.
4. Epic Metals Corporation.
5. Marlyn Steel Decks, Inc.
6. New Millennium Building Systems, LLC.
7. Nucor Corp.
8. Roof Deck, Inc.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 50, G60 zinc coating.

2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: As indicated.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

J. Galvanizing Repair Paint: ASTM A780/A780M.

K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 FLOOR DECK INSTALLATION

A. Fasten floor deck panels to steel supporting members as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Prepare test and inspection reports.

3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

END OF SECTION 053100

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 METALS

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

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

F. Zinc-Coated Steel Wire Rope: ASTM A 741.

1. Wire-Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

G. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches.
2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; 0.108-inch nominal thickness.
3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0966-inch minimum thickness; unfinished hot-dip galvanized after fabrication.

H. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

I. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

J. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

K. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

L. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).

M. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).

N. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.
3. Provide stainless-steel fasteners for fastening nickel silver.
4. Provide bronze fasteners for fastening bronze.

B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting."

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

H. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. 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.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches from ends and corners of units and 24 inches o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.

D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

2.7 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

2.8 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel pipe railings.
2. Aluminum tube railings.

B. Related Requirements:

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.4 QUALITY ASSURANCE

A. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with reqirments in Section 014000 “Quality Requirements” for mockups.

1. Build 3 foot sample section for each type of railing including final finish method.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS, GENERAL

A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 ALUMINUM

A. Aluminum, General: Provide 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.

B. Extruded Bars and Tubing: ASTM B 221, Alloy 6063-T5/T52.

C. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.5 FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
3. Aluminum Railings: Type 304 stainless-steel fasteners.

B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy [**Group 1**] [**Group 2**] stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

G. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

H. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.

I. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

J. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

K. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 FABRICATION

A. 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.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

D. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

E. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

F. Form changes in direction by bending or by inserting prefabricated elbow fittings.

G. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

H. Close exposed ends of railing members with prefabricated end fittings.

I. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

2.8 STEEL AND IRON FINISHES

A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

B. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Do not apply primer to galvanized surfaces.

C. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

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

2.9 ALUMINUM FINISHES

A. 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 unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

3.2 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members.

3.3 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

END OF SECTION 055213

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stainless-steel decorative railings with stainless-steel wire-rope guard infill.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

   1. Manufacturer's product lines of railings assembled from standard components.
   2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 QUALIFICATIONS

A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of aluminum handrails and railings of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 5 years.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

C. Installer Qualifications: Minimum 2 years experience installing similar systems.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

C. Preconstruction test reports.

D. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Pre-Installation Meeting:
   1. Prior to the beginning of work, conduct a pre-job conference at the job site.
   2. Provide seven calendar days advance written notice ensuring the attendance by competent authorized representatives of the fabricator, building owner's representative, architect and subcontractors whose work interfaces with the work of this section.
   3. Review the specifications to determine any potential problems, changes, scheduling, unique job site conditions, installation requirements and procedures and any other information pertinent to the installation.
   4. Record the results of the conference and furnish copies to all participants.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

   1. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components.

1.6 WARRANTY

A. Special Warranty: Provide manufacturer's standard form outlining the terms and conditions of their standard Limited Warranty:
   1. Cable and Connectors: 10 year limited warranty against defects in materials and workmanship.
   2. Paint Finish on Aluminum Extrusions and Components: 10 year limited warranty against cracking, flaking, blister, and peeling.

B. Additional Owner Rights: The warranty 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.

1.7 EXTRA MATERIALS

A. Provide one approximately 3 ounce (85 grams) can, of touch-up paint per 100 feet (30.5 m) of each color of railing as applicable.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Stainless-Steel Decorative Railings:
   1. Basis-of-Design: Provide Steel Post Cable Railing Kits and Components as manufactured by Stair Supplies, 1722 Eisenhower Drive North, Suite B, Goshen, IN 46526, (866) 255-6536, https://www.stairsupplies.com/.
   2. Alternate Manufacturers:

a. Stainless Cable & Railing Inc., Vancouver Business Park, 3315 NE 112th Ave., Vancouver, WA 98682, (888) 686-7245, https://stainlesscablerailing.com/ .
b. The Wagner Companies, 10600 W Brown Deer Road, Milwaukee, WI 53324, (414) 214-0444, https://wagnercompanies.com/ .
c. Or approved equal.

B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

2.3 METALS, GENERAL

A. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.4 STAINLESS STEEL

A. Tubing: ASTM A554, Grade MT 304.

B. Pipe: ASTM A312/A312M, Grade TP 304.

C. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.

D. Sheet, Strip, Plate, and Flat Bar: ASTM A666, Type 304.

E. Bars and Shapes: ASTM A276, Type 304.

F. Wire Rope and Fittings:
1. Wire Rope: 1-by-19 wire rope made from wire complying with ASTM A492, Type 316.
2. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

2.5 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:
1. Stainless-Steel Components: Type 304 stainless-steel fasteners.
2. Dissimilar Metals: Type 304 stainless-steel fasteners.

B. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Connections: Fabricate railings with welded or nonwelded connections unless otherwise indicated.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds; no evidence of a welded joint.

D. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

E. Form changes in direction by bending or by inserting prefabricated elbow fittings.

F. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

G. Close exposed ends of hollow railing members with prefabricated end fittings.

H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

2.7 STAINLESS STEEL FINISHES

A. Directional Brushed Satin Finish: ASTM A480/A480M, No. 4.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet. Adjusting: Adjust handrails and railings before anchoring to ensure alignment at abutting joint's space posts at interval indicated, but not less than required to achieve structural loads.
3. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Attach handrails to walls with wall brackets except where end flanges are used.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

E. Secure wall brackets and railing end flanges to building construction as follows:
1. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.

3.2 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, and abraded areas of shop paint, and appoint exposed areas with same material.

B. Passivation: Immediately after erection, spray passivation solution on stainless steel frame pieces and cables to restore protective layer.

C. Cleaning: Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

3.3 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to the Installer that shall ensure that the aluminum handrails and railings shall be without damage at time of Substantial Completion.

B. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.

C. Protect stainless steel from corrosion and staining by applying passivation solution following installation and periodically thereafter.

END OF SECTION 057300

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Wood blocking, cants, and nailers.
4. Plywood panels.

1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. 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. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

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

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

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

C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Wood-preservative-treated wood.
2. Engineered wood products.
3. Expansion anchors.
4. Metal framing anchors.

1.5 QUALITY ASSURANCE

A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

B. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

1. Dimension lumber framing.
2. Laminated-veneer lumber.
3. Parallel-strand lumber.
4. Miscellaneous lumber.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with 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 grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:
1. Wood floor plates that are installed over concrete slabs-on-grade.
2. Exterior wood beams.

2.3 DIMENSION LUMBER FRAMING

A. Maximum Moisture Content: 19 percent.

B. Non-Load-Bearing Interior Partitions: As indicated on drawings

C. Exterior and Load-Bearing Walls: As indicated on drawings

D. Ceiling Joists (Non-Load-Bearing): Construction or No. 2 grade of any species.

E. Joists, Rafters, and Other Framing Not Listed Above: As indicated on drawings

F. Exposed Exterior Interior Framing Indicated to Receive a Stained or Natural Finish: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on

exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species and Grade: As indicated above for load-bearing construction of same type.

2.4 ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559 and containing no urea formaldehyde.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Boise Cascade Corporation.
      b. Finnforest USA.
      c. Georgia-Pacific.
      d. Louisiana-Pacific Corporation.
      e. Pacific Woodtech Corporation.
      f. Roseburg Forest Products Co.
      g. Weldwood of Canada Limited; Subsidiary of International Paper Corporation.
      h. Weyerhaeuser Company.

   2. Extreme Fiber Stress in Bending, Edgewise: As indicated on drawings
   3. Modulus of Elasticity, Edgewise: As indicated on drawings.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.
   4. Cants.
   5. Furring.
   6. Grounds.
   7. Utility shelving.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.

C. For exposed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:
   1. Mixed southern pine, No.2 grade

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.6 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

2.8 METAL FRAMING ANCHORS

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:

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

C. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Drawings or comparable products by one of the following:

1. Alpine Engineered Products, Inc.
2. Cleveland Steel Specialty Co.
3. Harlen Metal Products, Inc.
4. KC Metals Products, Inc.
5. Simpson Strong-Tie Co., Inc.
6. Southeastern Metals Manufacturing Co., Inc.
7. USP Structural Connectors.

D. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

E. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations where stainless steel is not indicated.

F. Joist Hangers: U-shaped joist hangers with 2-inch- long seat and 1-1/4-inch- wide nailing flanges at least 85 percent of joist depth.

1. Thickness: 0.050 inch.

G. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.

H. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch- minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.

I. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below per drawings

J. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches wide by 0.050 inch thick by 36 inches long.

K. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.

1. Bolt Diameter: per drawings
2. Width: per drawings
3. Body Thickness: per drawings
4. Base Reinforcement Thickness: per drawings

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. 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 nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

E. Do not splice structural members between supports, unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

G. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

I. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WALL AND PARTITION FRAMING INSTALLATION

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction, unless otherwise indicated.

1. For exterior walls, provide framing as indicated
2. For interior partitions and walls, provide framing as indicated
3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
2. For load-bearing walls, provide jamb studs as indicated on the drawings.

3.4 STAIR FRAMING INSTALLATION

A. Provide stair framing members of size, space, and configuration indicated or, if not indicated, to comply with the following requirements:

1. Stringer Size: 2-by-12-inch nominal- size, minimum.
2. Stringer Material: solid lumber.
3. Notching: Notch stringers to receive treads, risers, and supports; leave at least 3-1/2 inches of effective depth.
4. Stringer Spacing: At least 3 stringers for each 36-inch clear width of stair.

B. Provide stair framing with no more than 3/16-inch variation between adjacent treads and risers and no more than 3/8-inch variation between largest and smallest treads and risers within each flight.

3.5 PROTECTION

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

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Wood roof trusses.
2. Wood girder trusses.
3. Wood truss bracing.
4. Wood floor trusses.
5. Metal truss accessories.

B. Allowances: Provide wood truss bracing under the Metal-Plate-Connected Truss Bracing Allowance as specified in Division 01 Section "Allowances."

1.3 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

B. TPI: Truss Plate Institute, Inc.

C. 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: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

1. Design Loads: As indicated on drawings
2. Maximum Deflection Under Design Loads:

a. Roof Trusses:
   1) Vertical deflection of 1/240 of span under total load.
   2) Vertical deflection of l/360 of span under live load.

b. Floor Trusses:
   1) Vertical deflection of 1/240 of span under total load.
   2) Vertical deflection of l/360 of span under live load.

1.5 SUBMITTALS

A. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer. Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
5. Show splice details and bearing details.
6. For installed products indicated to comply with design loads, include structural analysis data **signed and sealed by the qualified professional structural engineer** responsible for their preparation.

B. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.

C. Qualification Data: For metal-plate manufacturer professional engineer fabricator and Installer.

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

E. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. Metal-plate connectors.
2. Metal truss accessories.

1.6 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

C. Source Limitations for Connector Plates: Obtain metal connector plates from a single manufacturer.

D. Comply with applicable requirements and recommendations of the following publications:

1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."

E. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

F. Forest Certification: Provide metal-plate-connected wood trusses produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations of TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."

1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.8 COORDINATION

A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

PART 2 - PRODUCTS

2.1 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Provide dressed lumber, S4S.
3. Provide dry lumber with 15 percent maximum moisture content at time of dressing.

B. Grade and Species: For truss chord and web members, provide dimension lumber of any species, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

C. Grade and Species: Provide visually graded dimension lumber for truss chord and web members, of not less than the following grade and any of the following species:

1. Grade for Chord Members: No. 2.
2. Grade for Web Members: No. 2.
3. Species: Southern pine; SPIB.
4. Species: Spruce-pine-fir (south); NELMA, WCLIB, or WWPA.

D. Grade and Species: Provide dimension lumber of any species for truss chord and web members, graded as follows and of the following minimum design values for size of member required according to AF&PA's "National Design Specifications for Wood Construction" and its "Supplement":

1. Grading Method: Visual or mechanical.
2. Design Values: As indicated on Drawings.

E. Minimum Chord Size For Roof Trusses: 2 by 4 inches nominal for both top and bottom chords.

F. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Division 06 Section Rough Carpentry.

2.2 METAL CONNECTOR PLATES

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:

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

1. Alpine Engineered Products, Inc.
2. Cherokee Metal Products, Inc.; Masengill Machinery Company.
3. CompuTrus, Inc.
4. Eagle Metal Products.
5. Jager Building Systems, Inc.
6. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.
7. Robbins Engineering, Inc.
8. TEE-LOK Corporation; a subsidiary of Berkshire Hathaway Inc.
9. Truswal Systems Corporation.

C. General: Fabricate connector plates to comply with TPI 1.

D. Hot-Dip Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.

1. Use for interior locations where stainless steel is not indicated.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

2.4 METAL TRUSS ACCESSORIES

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:

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

C. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Drawings or comparable products by one of the following:

1. Cleveland Steel Specialty Co.
2. Harlen Metal Products, Inc.
3. KC Metals Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. Southeastern Metals Manufacturing Co., Inc.
6. USP Structural Connectors.

D. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

E. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations where stainless steel is not indicated.

F. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, as indicated on drawings. Tie fits over top of truss and fastens to both sides of truss, top plates, and one side of stud below.

G. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.

H. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches wide by 1 inch deep by 0.040 inch thick, made to fit between 2 adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

2.5 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

B. Protective Coatings: SSPC-Paint 22, epoxy-polyamide primer.

2.6 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in truss accessories according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.

1. Anchor trusses to girder trusses as indicated.

I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install bracing to comply with Division 06 Section Rough Carpentry.
2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not cut or remove truss members.

L. Replace wood trusses that are damaged or do not meet requirements.

1. Do not alter trusses in field.

3.2 REPAIRS AND PROTECTION

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

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

C. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

D. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.

1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION 061753

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior trim.
2. Interior plywood paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

B. Samples: For each type of paneling.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Softwood Plywood: DOC PS 1.

B. MDF: ANSI A208.2, Grade 130.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

1. For exposed lumber and plywood indicated to receive a stained or natural finish, mark back of each piece.

C. Application: Where indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.2 INSTALLATION, GENERAL

A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
4. Install stairs with no more than 3/16-inch variation between adjacent treads and risers and with no more than 3/8-inch variation between largest and smallest treads and risers within each flight.

3.3 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints.

END OF SECTION 062023

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standing and running trim.
2. Interior frames and jambs.
3. Interior stairs and railings.
4. Wood furring, blocking, shims, and hanging strips for installing interior architectural woodwork items that are not concealed within other construction.
5. Shop priming of interior architectural woodwork.
6. Shop finishing of interior architectural woodwork.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Anchors.
2. Adhesives.
3. Shop finishing materials.
4. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:

1. Include the following:

a. Dimensioned plans, elevations, and sections.
b. Attachment details.

2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.

C. Samples: For each exposed product and for each shop-applied color and finish specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For architectural woodwork manufacturer and Installer.

B. Product Certificates: For the following:

1. Composite wood and agrifiber products.
2. Adhesives.

C. Field quality-control reports.

D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups of typical interior architectural woodwork as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

PART 2 - PRODUCTS

ARCHITECTURAL WOODWORK, GENERAL

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

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Premium.

B. Hardwood Lumber:

1. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.

2. Wood Moisture Content: 5 to 10 percent.
3. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
4. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.

    a. For veneered base, use hardwood lumber core, glued for width.

5. For base wider than available lumber, glue for width. Do not use veneered construction.
6. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.

C. Softwood Lumber:

1. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.
2. Wood Moisture Content: 5 to 10 percent.
3. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
4. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.

    a. For veneered base, use softwood lumber core, glued for width.

5. For base wider than available lumber, glue for width. Do not use veneered construction.
6. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.
7. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.

2.3 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Architectural Woodwork Standards Grade: Premium.

1. Wood Species: Any closed-grain hardwood.
2. Wood Moisture Content: 5 to 10 percent.

2.4 INTERIOR FRAMES AND JAMBS FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Premium.

B. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.
1. Wood Moisture Content: 5 to 10 percent.
2. Provide split species on frames and jambs that face areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

C. For frames or jambs wider than available lumber, use veneered construction. Do not glue for width.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.

2.5 INTERIOR FRAMES AND JAMBS FOR OPAQUE FINISH

A. Architectural Woodwork Standards Grade: Premium.

B. Wood Species: Any closed-grain hardwood.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
2. Wood Moisture Content: 5 to 10 percent.

2.6 INTERIOR WOOD STAIRS AND RAILINGS

A. Architectural Woodwork Standards Grade: Premium.

B. Wood for Transparent Finish:

1. Species and cut:

a. Stringers: Red oak, plain sawn.
b. Risers: Red oak, plain sawn.
c. Treads: Red oak, plain sawn.
d. Railings: Red oak, plain sawn.
e. Balusters: Red oak, plain sawn.
f. Newels: Red oak, plain sawn.
g. Moldings: Red oak, plain sawn.

2. Wood Moisture Content: 5 to 10 percent.

C. Wood for Opaque Finish:

1. Species: Any closed-grain hardwood.
2. Wood Moisture Content: 5 to 10 percent.

D. Rough Carriages for Stairs: Laminated veneer lumber, made with an exterior-type adhesive complying with ASTM D2559, and with the following allowable design values as determined according to ASTM D5456:

E. Handrail Brackets: Cast nickel-silver with wall flange drilled and with support arm for screwing to underside of rail. Size to provide 1-1/2-inch clearance between handrail and face of wall.

F. Handrail/Bumper Rail Brackets: Pairs of extruded-aluminum channels: one for fastening to back of rail and one for fastening to face of wall, assembled in overlapping fashion and fastened

together at top and bottom with self-tapping screws. Size to provide 1-1/2-inch clearance between handrail and wall.

2.7 HARDWOOD SHEET MATERIALS

A. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of the Architectural Woodwork Standards for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.
   1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
   2. Particleboard: ANSI A208.1, Grade M-2.
   3. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.

   4. Softwood Plywood: DOC PS 1, medium-density overlay.
   5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.8 FIRE-RETARDANT-TREATED WOOD MATERIALS

A. Fire-Retardant-Treated Wood Materials: Where fire-retardant-treated materials are indicated, use materials complying with requirements that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products according to test method indicated by a qualified testing agency.

   1. Use treated materials that comply with requirements of the Architectural Woodwork Standards. Do not use materials that are warped, discolored, or otherwise defective.
   2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
   3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

   1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
   2. For items indicated to receive a stained, transparent, or natural finish, use organic resin chemical formulation.
   3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
   4. Mill lumber before treatment, and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less according to ASTM E84.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2, except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.
3. For panels 13/16 to 1-1/4 inches thick, comply with ANSI A208.1 for Grade M-1, except for the following minimum properties: modulus of rupture, 1300 psi; modulus of elasticity, 250,000 psi; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf, respectively.

D. Fire-Retardant Fiberboard: Medium-density fiberboard (MDF) panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less according to ASTM E84.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.9 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

1. Preservative Treatment: Provide softwood lumber treated by pressure process, AWPA U1; Use Category UC3b.

   a. Provide where in contact with concrete or masonry.
   b. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
   c. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
   d. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.

2. Fire-Retardant Treatment: Complying with requirements; provide where indicated.

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.10 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.

1. Ease edges to radius indicated for the following:

a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
b. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.

1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
3. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.

a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

D. Stairs: Cut rough carriages to accurately fit treads and risers.

1. Glue treads to risers, and glue and nail treads and risers to carriages.
2. House wall and face stringers, and glue and wedge treads and risers.
3. Fabricate stairs with treads and risers no more than 1/8 inch from indicated position and no more than 1/16 inch out of relative position for adjacent treads and risers.

2.11 SHOP PRIMING

A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

B. Interior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer as specified in Section 099123 "Interior Painting."

1. Backpriming: Apply one coat of primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

C. Interior Architectural Woodwork for Transparent Finish: Shop-seal concealed surfaces with required pretreatments and first coat of finish as specified in Section 099300 "Staining and Transparent Finishing."

1. Backpriming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

2.12 SHOP FINISHING

A. Finish interior architectural woodwork indicated on Drawings at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with Architectural Woodwork Standards, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Premium.
2. Finish: System - 1, Lacquer, Nitrocellulose.
3. Finish: System - 2, Lacquer, Pre Catalyzed.
4. Finish: System - 3, Lacquer, Post Catalyzed.
5. Finish: System - 4, Latex Acrylic, Water Based.
6. Finish: System - 5, Varnish, Conversion.
7. Finish: System - 6, Oil, Synthetic Penetrating.
8. Finish: System - 7, Vinyl, Catalyzed.
9. Finish: System - 8, Acrylic Cross Linking, Water Based.
10. Finish: System - 9, UV Curable, Acrylated Epoxy, Polyester, or Urethane.
11. Finish: System - 10, UV Curable, Water Based.
12. Finish: System - 11, Polyurethane, Catalyzed.
13. Finish: System - 12, Polyurethane, Water Based.
14. Finish: System - 13, Polyester, Catalyzed.
15. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
16. Staining: Match approved sample for color.
17. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
18. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
19. Sheen: Flat, 15-30 gloss units measured on 60-degree gloss meter according to ASTM D523.

D. Opaque Finish:

1. Architectural Woodworking Standards Grade: Premium.
2. Finish: System - 1, Lacquer, Nitrocellulose.
3. Finish: System - 2, Lacquer, Pre Catalyzed.
4. Finish: System - 3, Lacquer, Post Catalyzed.
5. Finish: System - 4, Latex Acrylic, Water Based.
6. Finish: System - 5, Varnish, Conversion.

7. Finish: System - 7, Vinyl, Catalyzed.
8. Finish: System - 8, Acrylic Cross Linking, Water Based.
9. Finish: System - 9, UV Curable, Acrylated Epoxy, Polyester, or Urethane.
10. Finish: System - 10, UV Curable, Water Based.
11. Finish: System - 11, Polyurethane, Catalyzed.
12. Finish: System - 12, Polyurethane, Water Based.
13. Finish: System - 13, Polyester, Catalyzed.
14. Color: As indicated by manufacturer's designations.
15. Sheen: Flat, 15-30 gloss units measured on 60-degree gloss meter according to ASTM D523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

C. Install interior architectural woodwork level, plumb, true in line, and without distortion.

1. Shim as required with concealed shims.
2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWPA M4.

F. Fire-Retardant-Treated Wood: Install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

G. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.

1. Secure with countersunk, concealed fasteners and blind nailing.

2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
3. For shop-finished items, use filler matching finish of items being installed.

H. Standing and Running Trim:

1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
2. Do not use pieces less than 36 inches long, except where shorter single-length pieces are necessary.
3. Scarf running joints and stagger in adjacent and related members.
4. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

I. Stairs: Securely anchor carriages to supporting substrates.

1. Install stairs with treads and risers no more than 1/8 inch from indicated position.
2. Secure with countersunk, concealed fasteners and blind nailing.
3. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with wood surface.

J. Railings:

1. Install rails with no more than 1/8 inch in 96-inch variation from a straight line.
2. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.

    a. Secure with countersunk, concealed fasteners and blind nailing.
    b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with wood surface.

3. Wall Rails: Support rails on wall brackets securely fastened to wall framing.

    a. Space rail brackets not more than o.c.

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets that are not concealed within other construction.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: For plastic-laminate-faced architectural cabinets.

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

C. Samples: For each exposed product and for each color and texture specified.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

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

B. Grade: Custom.

C. Type of Construction: Face frame.

D. Door and Drawer-Front Style: Full overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGL.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade VGS.
4. Edges: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

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

1. As indicated by laminate manufacturer's designations.
2. Match Architect's sample.
3. As selected by Architect from laminate manufacturer's full range in the following categories:

a. Solid colors, matte finish.
b. Solid colors with core same color as surface, matte finish.
c. Wood grains, matte finish.
d. Patterns, matte finish.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard (MDF): ANSI A208.2,.
2. Particleboard: ANSI A208.1, Grade M-2.

3. Straw-Based Particleboard: ANSI A208.1, Grade M-2, except for density.

4. Softwood Plywood: DOC PS 1, medium-density overlay.
5. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.

C. Hardware: As indicated on Drawings.

D. Back-Mounted Pulls: BHMA A156.9, B02011.

E. Catches: Magnetic catches, BHMA A156.9, B03141.

F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

G. Shelf Rests: BHMA A156.9, B04013; metal.

H. Drawer Slides: BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted.

    a. Type: Full extension.
    b. Material: Zinc-plated steel with polymer rollers.

2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 2.
4. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1.
5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.
6. For computer keyboard shelves, provide Grade 1.
7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-100.

I. Slides for Sliding Glass Doors: BHMA A156.9, B07063; plastic.

J. Door Locks: BHMA A156.11, E07121.

K. Drawer Locks: BHMA A156.11, E07041.

L. Door and Drawer Silencers: BHMA A156.16, L03011.

M. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: Black <**Insert color**>.

N. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Dark, Oxidized, Satin Bronze, Oil Rubbed: BHMA 613 for bronze base; BHMA 640 for steel base; match Architect's sample.
2. Bright Brass, Clear Coated: BHMA 605 for brass base; BHMA 632 for steel base.
3. Bright Brass, Vacuum Coated: BHMA 723 for brass base; BHMA 729 for zinc-coated-steel base.
4. Satin Brass, Blackened, Bright Relieved, Clear Coated: BHMA 610 for brass base; BHMA 636 for steel base.
5. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
6. Bright Chromium Plated: BHMA 625 for brass or bronze base; BHMA 651 for steel base.
7. Satin Stainless Steel: BHMA 630.

O. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 INSTALLATION

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

B. Grade: Install cabinets to comply with quality standard grade of item to be installed.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inchesusing concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

END OF SECTION 064116

SECTION 064300 - WOOD STAIRS AND RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood stairs and railings, including rough carriages for stairs.
2. Shop finishing of wood stairs and railings.

1.2 ACTION SUBMITTALS

A. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1.3 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wood stairs and railings 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.

PART 2 - PRODUCTS

2.1 WOOD STAIRS AND RAILINGS

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

B. Grade: Premium.

C. Wood for Opaque Finish: Any closed-grain hardwood.

D. Finishes for Stair Parts: As follows:

1. Treads: Opaque.
2. Risers: Opaque.
3. Stringers: Opaque.
4. Handrails: Transparent.
5. Scotia, Cove, and Other Moldings: Opaque.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 to 13 percent.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Rough Carriages for Stairs: Laminated veneer lumber, made with an exterior-type adhesive complying with ASTM D 2559, and with the following allowable design values as determined according to ASTM D 5456:

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.4 FABRICATION

A. Fabricate wood stairs and railings to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition wood stairs and railings to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

A. Grade: Install wood stairs and railings to comply with same grade as item to be installed.

B. Stairs: Securely anchor carriages to supporting substrates. Install stairs with treads and risers no more than 1/8 inch from indicated position.

C. Railings:

1. General: Install rails with no more than 1/8 inch in 96-inch variation from a straight line.
2. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.
3. Wall Rails: Support rails on indicated metal brackets securely fastened to wall framing.

D. Touch up finishing work specified in this Section after installation of wood stairs and railings. Fill nail holes with matching filler where exposed.

END OF SECTION 064300

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Glass-fiber blanket.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research reports.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded polystyrene boards in this article are also called "XPS boards."

B. Extruded Polystyrene Board, Type X: ASTM C 578, Type X, 15-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 GLASS-FIBER BLANKET

A. Glass-Fiber Blanket, Foil Faced: ASTM C 665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

2.3 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.2 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

6. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:

    a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

7. 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 [**exterior of construction**] [**interior of construction**] [**as indicated on Drawings**].
    b. Interior Walls: Set units with facing placed [**as indicated on Drawings**] [**toward areas of high humidity**] <**Insert location**>.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

END OF SECTION 072100

SECTION 072119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Open-cell spray polyurethane foam.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research reports.

PART 2 - PRODUCTS

2.1 OPEN-CELL SPRAY POLYURETHANE FOAM

A. Open-Cell Spray Polyurethane Foam: Spray-applied polyurethane foam using water as a blowing agent. Minimum density of 0.4 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 3.4 deg F x h x sq. ft./Btu at 75 deg F.
   1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 450 or less.
   2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

D. All spray insulation exposed to the interior of the structure, whether in finished or unfinished space, shall be provided with a radiant and ignition barrier consisting of one layer of 5/8" type X gypsum wallboard.

END OF SECTION 072119

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Building wrap.
   2. Flexible flashing.
   3. Drainage material.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
   1. Water-Vapor Permeance: Not less than 75 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).
   2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 FLEXIBLE FLASHING

A. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
   1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

B. Rubberized-Asphalt Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
   1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

2.3 DRAINAGE MATERIAL

A. Drainage Material: Product shall maintain a continuous open space between water-resistive barrier and exterior cladding to create a drainage plane and shall be used under siding.
   1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover sheathing with water-resistive barrier as follows:

   1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
   2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

B. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.

   1. Seal seams, edges, fasteners, and penetrations with tape.
   2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.

   1. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
   2. Lap flashing over water-resistive barrier at bottom and sides of openings.
   3. Lap water-resistive barrier over flashing at heads of openings.

3.3 DRAINAGE MATERIAL INSTALLATION

A. Install drainage material over building wrap and flashing to comply with manufacturer's written instructions.

END OF SECTION 072500

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes
   1. Standing-seam metal roof panels.
   2. Snow guards.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Energy Performance: Provide roof panels that are listed on the EPA/DOE's ENERGY STAR "Roof Product List" for low-slope roof products.

B. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:

1. Three-year, aged solar reflectance of not less than 0.55 and emissivity of not less than 0.75.
2. Three-year, aged Solar Reflectance Index of not less than 64 when calculated according to ASTM E 1980.

C. 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 1/240 of the span.

D. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 or ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

E. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

F. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

H. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A- 120.
2. Hail Resistance: SH.

I. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.

B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
1. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

a. Nominal Thickness: 0.022 inch.
b. Exterior Finish: Two-coat fluoropolymer.
c. Color: As selected by Architect from manufacturer's full range.

2. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

    a. Thickness: 0.032 inch.
    b. Surface: Smooth, flat finish.
    c. Exterior Finish: Two-coat fluoropolymer.
    d. Color: As selected by Architect from manufacturer's full range.

3. Clips: Two-piece floating to accommodate thermal movement.

    a. Material: 0.028-inch- nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.

4. Joint Type: As standard with manufacturer.
5. Panel Coverage: 12 inches.
6. Panel Height: 1.5 inches.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.

B. Felt Underlayment: ASTM D 226/D 22M, Type II (No. 30), asphalt-saturated organic felts.

C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

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 coating designation or ASTM A 792/A 792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, 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 ridges, 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-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, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters and Downspouts: Formed from same material as roof panels according to SMACNA's "Architectural Sheet Metal Manual." Finish to match roof fascia and rake trim.

E. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch-nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.

F. Panel Fasteners: Self-tapping screws designed to withstand design loads.

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; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; 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. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.6 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
2. Concealed Finish: White or light-colored acrylic or polyester backer finish.

2.7 SNOW GUARDS

A. Provide complete snow guard system. Provide Basis-of-Design Product: ColorGard manufactured by S-5 or approved equal. Components to match roof color.

B. Ice Stopper: Provide “ice stopper” centered on panel and mounted perpendicular to roof panel to prevent sliding over exterior door entrances.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.

B. Felt Underlayment: Apply at locations indicated below, in shingle fashion to shed water, and with lapped joints of not less than 2 inches.

1. Apply over the entire roof surface.

C. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

D. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.3 METAL PANEL INSTALLATION

A. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
4. Watertight Installation:

    a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
    b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
    c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

B. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

C. 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 will be permanently watertight and weather resistant.

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.

END OF SECTION 074113.16

SECTION 074646 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fiber-cement lap siding boards, panels, trim, fascia, soffit and accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For fiber-cement siding and soffit including related accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Research/evaluation reports.

D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications.
   1. All fiber cement boards specified in this section must be supplied by a manufacturer with a minimum of 10 years of experience in fabricating and supplying fiber cement cladding systems.
   2. Provide technical and design support as needed regarding installation requirements and warranty compliance provisions.

B. Installer Qualifications: All products listed in this section are to be installed by a single installer trained by manufacturer or representative.

C. Pre-Installation Meetings: Prior to beginning installation, conduct conference to verify and discuss substrate conditions, manufacturer’s installation instructions and warranty requirements, and project requirements.

D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Fiber cement boards must be stored flat and kept dry, off the ground before installation. A waterproof cover over boards and accessories should be used at all times prior to installation.

B. If boards are exposed to water or water vapor prior to installation, allow to completely dry before installing. Moisture saturation before installation can cause shrinkage and board damage.

C. Boards MUST be carried on edge. Do not carry or lift boards flat. Improper handling may cause cracking or board damage.

D. Do not stack product more than three pallets high.

1.7 WARRANTY

A. Provide manufacturer's 30-year limited warranty against manufactured defects in fiber cement boards.

B. Provide manufacturer's 15-year warranty against manufactured defects in board finish.

C. Warranty provides for the original purchaser and transfers to one subsequent owner. See warranty for detailed information on terms, conditions and limitations.

PART 2 - PRODUCTS

2.1 FC-1 SYSTEM MANUFACTURERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide Artisan Shiplap Siding from James Hardie Building Products of Chicago, Illinois.
1. Profile: Artisan HZ10 Shiplap Siding with Lock Joint System
2. Surface: Smooth Texture.
3. Accessory/Component Options:
   a. Aluminum trim as scheduled on the drawings: Outside corners (open outside corner), vertical joints (H-Mold), terminations (J-Mold).
4. Height: 10 ¼"; Exposure: 9".
5. Thickness: 5/16".
6. Length: 119-5/16".
7. Weight: 57.32 lbs. per panel.
8. Coverage: 14.81 sq. ft. per panel.
9. Factory sealed on six [6] sides.
10. No exposed fasteners shall be acceptable.

B. Alternate Manufacturers:
   1. As approved by the Architect.

2.2 FC-2 SYSTEM MANUFACTURERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide HardieReveal2.0 from James Hardie Building Products of Chicago, Illinois.
   1. Accessory/Component Options:
      a. Aluminum Interior and exterior corner trims and horizontal and vertical trims as scheduled on the drawings.
   2. Surface: Smooth Texture.
   3. Panel Size: 4’x8’.
   4. Cutting: Shears (manual, electric or pneumatic. Seal field-cut edges or cut-outs shall be coated with the provided sealer.
   5. Installation: Per manufacturer’s written standard details.
   6. Fastening: Countersunk, filled and sanded fasteners per manufacturer’s written standard instructions (typical all fasteners where exposed).

B. Alternate Manufacturers:
   1. As approved by the Architect.

2.3 FC-3 SYSTEM MANUFACTURERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide HardieSoffit Beaded Porch Panel from James Hardie Building Products of Chicago, Illinois.
   1. Accessory/Component Options:
      a. Interior and exterior corner trims and horizontal and vertical trims as scheduled on the drawings.
   2. Surface: Smooth Texture, beaded panel
   3. Panel Size: 4’x8’x1/4”. Orient panels as shown on drawings.
   4. Cutting: Shears (manual, electric or pneumatic. Seal field-cut edges or cut-outs shall be coated with the provided sealer.
   5. Installation: Per manufacturer’s written standard details.
   6. Fastening: Countersunk, filled and sanded fasteners per manufacturer’s written standard instructions (typical all fasteners where exposed).

B. Alternate Manufacturers:
   1. As approved by the Architect.

2.4 FIBER-CEMENT SIDING

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.

2.5 FIBER-CEMENT SOFFIT

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

B. Nominal Thickness: Not less than 5/16 inch.

C. Pattern: Sizes as shown on plans cut from 48” x 84” wide sheets with smooth texture. Confirm orientation of sheets with Architect.

D. Factory Priming: Manufacturer's standard acrylic primer.

2.6 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

B. Flashing: Provide stainless-steel Insert metal flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

C. Fasteners:

1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch into substrate.
2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
3. For fastening fiber cement, use hot-dip galvanized fasteners.

D. Insect Screening for Soffit Vents: Aluminum, 18-by-16 mesh or PVC-coated, glass-fiber fabric, 18-by-14 or 18-by-16 mesh.

E. Continuous Soffit Vents: Aluminum, hat-channel shape.

1. Net-Free Area: 4 sq. in./linear ft.
2. Finish: Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
1. Fiber cement boards must be installed over vertical braced wood with minimum 7/16” OSB or plywood sheathing.
2. Allowable stud spacing: 16” maximum.
3. A weather resistive barrier is required when installing fiber cement boards. Use an approved weather resistive barrier (WRB) as defined by the 2015 IRC. Refer to local building codes.

4. Appropriate flashing shall be used to prevent moisture penetration around all doors, windows, wall bottoms, material joints, transitions, and penetrations. Refer to local building codes for best practices.

B. Examine site to ensure substrate conditions are within specification for proper installation.

C. Do not begin installation until unacceptable conditions have been corrected.

D. Do not install boards or components that appear to be damaged or defective. Do not install wet boards.

3.2 INSTALLATION

A. General: Install products in accordance with the latest installation guidelines of the manufacturer and all applicable building codes and other laws, rules, regulations and ordinances. Review all manufacturer installation, maintenance instructions, and other applicable documents before installation.
   1. More than one pattern of boards may exist within each unit of boards in a manner which minimizes keyway alignment. Install boards with ends over studs or solid wood framing when possible with a minimum 16” stagger between courses. For additional keyway alignment options, boards may be reversed, or incorporate an increased stagger amount. Layout of the application may be necessary to avoid repetition or stacked keyways.

B. Board Cutting
   1. Always cut fiber cement boards outside or in a well ventilated area. Do not cut the products in an enclosed area.
   2. Always wear safety glasses and NIOSH/OSHA approved respirator whenever cutting, drilling, sawing, sanding or abrading the products. Refer to manufacturer SDS for more information.
   3. Use a dust-reducing circular saw with a diamond-tipped or carbide-tipped blade.
      a. Recommended circular saw: Makita 7-1/4” Circular Saw with Dust Collector (#5057KB).
      b. Recommended blade: Tenryu Board-Pro Plus PCD Blade (#BP-18505).
      c. Shears (electric or pneumatic) or jig saw can be used for complicated cuttings, such as service openings, curves, radii and scrollwork.
   4. Silica Dust Warning: Fiber cement products may contain some amounts of crystalline silica, a naturally occurring, potentially hazardous mineral when airborne in dust form. Consult product SDS or visit www.osha.gov/SLTC/silicacrystalline/index.html.

C. Fastening
   1. Fiber cement boards must be staggered a minimum of 16” after installing the first course. Where possible, align butt joints over framing.
   2. Fasteners at intermediate framing must penetrate wood studs at least 1”.
   3. Fastener head must be flush to the board surface or countersunk, filled and sanded per Manufacturer’s written instructions (typical all fasteners where exposed).
   4. Fasteners shall be placed at least 1” from the top edge and no closer than 1” from board ends.
   5. If face fastening, fasteners must be a minimum of 3/4” from the bottom edge but no more than 1” and no closer than 1” from board ends.

6. Butt joints/board ends must be fastened with #8, full thread, bugle head corrosion resistant screws.

D. Joint Installation Using Flashing (required): Attach joint flashing recommended for fiber cement siding and follow manufacturer's instructions. Joint flashing shall be at least 3" in width and long enough to extend above the board width a minimum of 2". Then install boards over flashing with moderate contact between board ends.

E. Horizontal Joints: A minimum 1-1/4" overlap is required. For top of windows/doors, leave ¼" gap over flashing or drip cap.

F. Trim Joints: For sides, bottom, and around windows and trim, leave a 1/8" gap and fill with recommended sealant. All horizontal trim must be flashed. Leave a ¼" gap between siding and flashing but do not caulk this gap.

3.3 ADJUSTING AND CLEANING

A. Review manufacturer guidelines for detailed care instructions.

B. Paint: All unfinished (pre-primed) products must be painted within 12 months of installation with exterior grade 100% acrylic latex paints. Follow the paint manufacturer's instructions for use, care, and future repainting. Do not use stain or oil based paints.

C. Field Cut Edges: All exposed field cut edges, such as outside edges, field cut butt joints, cuts around doors and windows, or bottom ends of corners and window trim, must be coated with primer, paint, or sealant.

D. Dents/Chips/Scratches: Any minor surface damage to fiber cement boards must be patched with exterior grade cementitious patching or putty. Follow the product instructions.

E. Sealant: Use an exterior grade high-quality sealant (caulk) that complies with either ASTM C-834 or ASTM C-920 for all gaps that require sealant. When replacing caulk in the future, carefully remove the old caulk first and then follow the manufacturer's instructions and siding manufacturer requirements.

F. Cleaning: Wash down exterior surfaces at least every 12 months to remove any dirt and debris. *DO NOT use high-pressure power washers which may damage fiber cement.* A mild household detergent and soft bristle brush or cloth may be used if needed. Rinse with clean water from a standard garden hose. For mildew removal, consult your paint manufacturer's instructions prior to the use of commercial mold and mildew cleaners.

END OF SECTION 074646

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Formed roof-drainage sheet metal fabrications.
2. Formed low-slope roof sheet metal fabrications.
3. Formed wall sheet metal fabrications.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; 2D (dull, cold rolled) finish.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
   1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
   2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

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

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
      c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
   2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

C. Solder:
   1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.
2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.

1. Accessories: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

1. Hanger Style: Hidden.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-Penetration Flashing: Fabricate from the following materials:
   1. Stainless Steel: 0.019 inch thick.

2.8 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
   1. Stainless Steel: 0.016 inch thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

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

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

   1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
   4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.

5. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 076200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Nonstaining silicone joint sealants.
2. Mildew-resistant joint sealants.
3. Latex joint sealants.
4. Butyl-rubber based sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

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

B. Samples: For each kind and color of joint sealant required.

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

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

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Preconstruction laboratory test reports.

C. Preconstruction field-adhesion-test reports.

D. Field-adhesion-test reports.

E. Sample warranties.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

2.3 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

2.4 JOINT-SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.5 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.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

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

3.3 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.4 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Construction joints in cast-in-place concrete.
    b. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

    a. Control joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    b. Tile control and expansion joints where indicated.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:

    a. Aluminum thresholds.
    b. Sill plates.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors .

END OF SECTION 079200

SECTION 082150 – SIMULATED STILE AND RAIL COMPOSITE INTERIOR DOORS

PART 1 - GENERAL

1.1 SELECTION INCLUDES

A. Standard and fire rated type wood doors with simulated panels.

B. Pre-fit and pre-machined simulated stile and rail wood doors.

1.2 REFERENCES

A. American National Standards Institute (ANSI)
   1. A115-W, WOOD DOOR HARDWARE STANDARDS Hardware Preparations.
   2. A117.1, Accessible and Usable Buildings and Facilities.

B. American Society for Testing and Materials (ASTM)
   1. ASTM E 119, Standard Test Methods for Fire Tests of Building Construction and Materials.

C. Door and Hardware Institute (DHI)
   1. Locations for architectural hardware for standard steel doors and frames.
   2. Sequence and format for the hardware schedule.
   3. Hardware for Labeled Fire Doors.
   4. Hardware for Health Care Facilities.
   5. Abbreviations and Symbols.

D. HPVA – Hardwood and Plywood Veneer Association.

E. International Building Code

F. National Fire Protection Association (NFPA)
   1. NFPA-80 Standard for Fire Doors and Windows.
   2. NFPA-105 Recommended Practice for the Installation of Smoke-Control Door Assemblies.
   3. NFPA-252 Standard Methods of Fire Tests of Door Assemblies.

G. Steel Door Institute (SDI)
   1. SDI-105 Recommended Erection Instructions for Steel Frames.
   2. SDI-117 Manufacturing Tolerances for Standard Steel Doors and Frames.
   3. SDI-122 Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
   4. SDI-124 Maintenance of Standard Steel Doors and Frames.

H. Underwriters Laboratories (UL)
   1. UL 10C Positive Pressure Fire Tests of Door Assemblies

I. Uniform Building Code (UBC):
   1. UBC 7-2, Fire Test of Door Assemblies.

J. Window and Door Manufacturers Association (WDMA)
1. IS 1, Industry Standard for Architectural Wood Doors.

1.3 SUBMITTALS

A. General Requirements:
1. Scope of work is to provide simulated stile and rail wood doors in compliance with the approved shop drawings, approved finish hardware schedule and approved door and frame schedule.
2. Wood doors to meet positive pressure Category A and B requirements.

B. Shop Drawings and Product Data:
1. Indicate general construction, jointing methods, hardware and louver locations, and locations of cutouts for glass if required.

C. Schedules:
1. Provide door and frame schedule in the DHI horizontal format.
2. Door and frame schedule to be prepared by a CDC (Certified Door Consultant) or someone of comparable experience.

D. Product Data:
1. Provide catalog cuts of each item.

E. Samples:
1. Submit 12” x 12” corner sample of each different type of door, i.e. PC, SCL, FD1.

F. Operations and Maintenance Data:
1. At date of acceptance provide owner with 1 copy of an owners Operations and Maintenance Manual. This manual is to be a 3-ring loose-leaf binder with the project name and address on the front cover and spine. In this manual are to be 1 copy of the following items:
a. As Built Door & Frame Schedule.
b. As Built Shop Drawings.
c. As Built Finish Hardware Schedule.
d. Door Manufacturer’s Installation Instructions.
e. Each related specification Section.
f. Name, address and phone number of the simulated stile and rail door manufacturer.
g. Name, address and phone number of the local manufacturers representative.
h. Name, address and phone number of the material supplier and contact person.
i. Manufacturers care and maintenance instructions.

G. Certification:
1. Submit certification that doors and frames comply with UBC 7-2.

1.4 QUALITY ASSURANCE

A. Fire-Rated Simulated Stile and Rail Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies in accordance NFPA

252 and which are labeled and listed for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.
1. Doors: Comply with UBC 7-2 where required.

B. Comply with UL-10C Category A and Category B.B. Temperature Rise Rating: At stairwell enclosures, provide doors that have Temperature Rise Rating of 250 degrees F maximum in 30 minutes of fire exposure.

C. Supplier Qualifications: Supplier to have a full time Certified Door Consultant (CDC) on staff or someone of comparable experience. Supplier to have been engaged in this type of business for 3 or more years.

D. Certification of Label Construction:
1. Warnock Hersey, Inc (WH)
2. Underwriters Laboratories, Inc. (UL)

E. Substitutions: Apply for substitutions in compliance with the requirements set fourth in Division 1 and no less than 10 business days prior to bid date.

1.5 DELIVERY STORAGE AND HANDLING

A. Site Conditions: Storage area for simulated stile and rail wood doors is to be in a dried, well ventilated, conditioned and secure area with controlled and stabilized humidity per manufacturers recommendation

B. Marking and Packaging:
1. Doors to be marked per the approved door and frame schedule.
2. Doors with R-Series, Architectural or Designer Moldings and L-Series Raised Moldings to be individually shrink wrapped with cardboard protective edges running the length of the stiles and then palletized.
3. C-Series Doors to be palletized and shrink wrapped.
4. L-Series Doors to be palletized and shrink wrapped.

C. Delivery: Coordinate delivery with Installer not less than 3 weeks prior to delivery.

D. Storage:
1. Follow the manufacturer’s Care and Installation guidelines.
2. Store Doors flat and palletized with not more than 20 door leafs per pallet.
3. Doors to be a minimum of 6” above floor while in storage.
4. Store Doors on a level surface.
5. Cover doors to keep clean and avoid discoloration with an opaque covering that does not permit light to penetrate. Cover must allow air circulation.

E. Handle doors with clean, white soft cotton gloves to prevent contamination by hand oils and dirt. Gloves are to be provided by whoever handles doors at any given time.

F. Do not drag doors across one another or across other surfaces. G. Handle doors per manufacturers recommendations.

1.6 GUARANTEE/WARRANTY

A. Manufacturer standard warranty indicating that the door will be free from material and workmanship defects from the date of manufacturer completion for the time periods indicated below:
   1. Door Unit: 10 years

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide the following:
   1. TRIA Composite Interior Doors by JELD-WEN, Inc.

B. Approved alternate manufacturers:
   1. Masonite, Tampa, FL.
   2. Simpson Door Company, McCleary, WA.

2.2 MATERIALS

A. Fire Rated MDF Doors with and without Molding
   1. Doors to comply with UL-10C, Category A or B. Attach proper fire label to door.
      a. Door construction to be manufacturer's standard construction for fire rated doors to comply with necessary test procedures and codes.
   2. Provide the following molding profile(s) on the fire rated doors:
      a. L-Series 90 minute.

B. L-Series Doors
   1. Door Construction 1-3/4" Raise Panel Doors: 7/8" Premium grade primed MDF (Medium Density Fiberboard) skins which sandwich individual raised panels in one of the following panel thickness – 9/16", 7/8", or 1-1/4". Provide 1" Fir Stiles on each vertical edge precision routed into and sandwiched between the MDF skins.
   2. Door Construction 1-3/4 20-Minute Fire Rated Doors: 7/8" Premium grade primed MDF (Medium Density Fiberboard) skins which sandwich individual raised panels of 1-1/4" thickness or individual Flat Panels of 11/16" thickness. Category B provide 1" Fir Stiles on each vertical edge precision routed into and sandwiched between the MDF skins. Category A provide 1" Hardwood stiles with built in intumescent strip on each vertical edge precision routed into and sandwiched between the MDF skins and 1" Hardwood top rail with built in intumescent strip.
   3. Adhesive: Use only moisture resistant Type 1 glue in the internal construction of the door.
   4. Moisture resistant Type 1 glue in the internal construction of the door.

2.3 ACCESSORIES

A. Fixed Lite Option:

1. General: Provide ¼" tempered glass installed in place of panel design. Furnish special raised glass lite molding to stop glass panels in place.
2. Refer to door elevations and details on plans.

2.4 FABRICATION

A. Fabricate wood doors in accordance with requirements of WDMA I.S. 1 Quality Standards.

B. Fabricate fire rated doors in accordance with requirements of ITS – Warnock Hersey or Underwriters' Laboratories, with metal label on each door including UL-10C.

C. Provide blocking for hardware per hardware manufacturers requirements for hardware to be installed without thru-bolts.

D. Factory prime doors for field finish.

E. Bevel lock and hinge edges of single acting doors 3 degrees or 1/8 inch in 2 inches.

F. Prepare doors to receive hardware. Refer to Section 0 87 10 - Hardware and NFPA 80 for hardware requirements including UL-10C.
1. Pre-fit and bevel to net opening size less approximately 1/4 inch in width on single swing doors 3/16" inch in width for paired doors. Provide 1/4 inch clearance above finished floor, unless otherwise indicated on drawings. Provide 1/8 inch clearance at top of door.
2. Slightly ease vertical edges.

2.5 SOURCE QUALITY CONTROL

A. Inspect doors prior to shipment, any doors that are damaged, not machined properly or defective shall be repaired to manufacturer's quality standards for new doors or be replaced prior to shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine installed door frames before hanging doors.

B. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level head.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Inspect jobsite to ensure a dry and secure area that meets manufacturer's storage recommendations is available and ready to receive the doors prior to delivery of doors.

3.2 PREPARATION

A. Prior to delivery of wood doors, and while wood doors are being stored, the storage area shall:
   1. Be free of all trash and debris.
   2. Meet manufacturer's recommendations for storage of wood doors.
   3. Be conditioned and have stabilized humidity control.

3.3 INSTALLATION

A. Handle doors in accordance with recommendations of WDMA I.S. 1, "Care and Installation at Job Site."

B. Condition doors to average temperature and humidity in area of installation for not less than 48 hours prior to installation. Store doors per recommendations of WDMA I.S. 1, "Care and Installation at Job Site."

C. Install in neat and workmanlike manner, free from hammer or tool marks, open joints or slivers.

D. Set plumb, level, square and true. Install doors after building humidity is at acceptable level.

E. Remove and replace all warped, twisted, bowed, or otherwise damaged doors. Do not install doors that cannot be properly fitted to frames.

F. Adjust doors and hardware and other moving or operating parts to function smoothly and correctly.

G. The field finishing process must follow the WDMA I.S. 1, "Care and Handling at Job Site" instructions for field applied finishes.

H. Protect the work of other trades damage from the installation of doors and frames.

I. Install doors in accordance with the following:
   1. Manufacturer's instructions, recommendations and tolerances.
   2. NFPA-80
   3. SDI-105
   4. Approved Finish Hardware Schedule
   5. Approved Door and Frame Schedule
   6. Approved Shop Drawings
   7. All applicable codes and requirements

3.4 CARE AND FINISHING

A. Finish doors in accordance with door manufacturer's Care and Finishing instructions.

B. All six sides of door must be sealed. Including top and bottom.

3.5 ADJUSTING AND CLEANING

A. Prior to final acceptance and at no additional cost to owner:
   1. Adjust doors to meet required tolerances:

2. General Contractor to clean doors per manufacturer's instructions to be free from all foreign materials.
3. Repair damaged doors per manufacturer's instructions and guidelines.
4. Replace damaged doors that cannot be repaired to the manufacturers standards of quality.
5. Replace defective doors.

3.6 PROTECTION

A. Keep poly bags on doors until date of acceptance.

B. Protect doors from damage by other trades.

C. Keep area around doors free from trash and debris.

D. Protect doors as directed under Section 017000.

END OF SECTION 082150

SECTION 083513 - FOLDING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Folding acoustical partitions. Partitions shall be furnished, installed and serviced by wall manufacturer's authorized distributor, in compliance with the architectural drawings and specifications contained herein.

1.2 RELATED WORK

A. Insulation: Sound insulation and baffles for the plenum area above the folding acoustical partition(s), under the permanent floor, inside air ducts passing over or around the folding acoustical partition(s), and in permanent walls adjoining the folding acoustical partition(s) shall be by others, in accordance with ASTM E 557.

B. Opening Preparation: Proper and complete preparation of the folding acoustical partition opening shall be by others in accordance with ASTM E 557, and shall include floor leveling; plumbness of adjoining permanent walls; substrate and / or ceiling tile enclosures and the painting and finishing of trim and other materials adjoining the head and jamb areas of the folding acoustical partition(s). Any permanent wall(s) receiving an adjustable hinged jamb will require internal structural blocking in order to secure the jamb to the permanent wall. Refer to a copy of the shop drawings for additional details.

1.3 SYSTEM DESCRIPTION

A. The folding acoustical partition(s) shall consist of Individual Panel(s) or two (2) panels hinged together that are manually operated and hinged permanently and directly to a structural wall surface.

B. The folding acoustical partition(s) shall consist of acoustically rated panels constructed of the same panel construction as the operable wall system.

1.4 QUALITY ASSURANCE

A. The folding acoustical partition(s) panel construction and finish materials shall consist of Class A rated materials (except as noted, under "Finishes" Part 2 – Products) in accordance with ASTM E84.

B. The folding acoustical partition(s) shall be installed by the manufacturer's authorized distributor in accordance with ASTM E 557.

1.5 REFERENCES

A. ASTM E 557: Architectural Application and Installation of Operable Partitions.

B. ASTM E 84: Surface Burning Characteristics of Building Materials.

C. ASTM A 653: Specification for General Requirements for Steel Sheet, Alloy-Coated (Galvannealed) by the Hot Dip Process.

D. ASTM C 423: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

E. CCC-W-408A: Federal Specification which applies to Vinyl Coated Wall Coverings.

F. CFFA-W-101-D: Chemical Fabrics and Film Association Quality Standard for Vinyl Coated Fabric Wall Coverings.

1.6 SUBMITTALS

A. Manufacturer shall provide written technical information and related detail drawings, which demonstrate that the products comply with contract documents for each type of folding acoustical partition(s) specified.

B. Manufacturer shall provide detailed engineering drawings featuring panel elevation, horizontal and vertical details as required.

C. Manufacturer shall provide written instructions specifying the proper operation and maintenance of the folding acoustical partition(s) system.

D. Manufacturer shall provide a color selector demonstrating the manufacturer's selections of the specified finish material. Samples shall consist of actual swatches of the specified finish material.

1.7 DELIVERY, STORAGE AND HANDLING

A. Folding acoustical partition(s) shall be individually wrapped in a protective plastic covering to keep panels clean during delivery, storage and handling.

B. Folding acoustical partition(s) shall be stored on edge and above the floor on cushioned blocking in a dry and ventilated area, protected from humidity and temperature extremes.

1.8 SEQUENCING / SCHEDULING

A. Folding acoustical partition(s) Installation: Folding acoustical partition(s) installation shall occur after fixed wall substrate construction is properly and completely installed by others, as required to protect panels from ongoing adjacent construction.

1.9 WARRANTY

A. Manufacturer shall warrant each folding acoustical partition(s) and its component parts to be free from defects in material and workmanship for a period of five (5) years from the date of delivery to the original purchaser, when installed by an authorized manufacturer's distributor.

PART 2 - PRODUCTS

2.1 FOLDING ACOUSTICAL PARTITIONS

A. Manufacturer.
1. Basis-of-Design Product: Folding acoustical partitions shall be Series 2000 as manufactured by KWIK-WALL Company.
a. Alternate manufacturers:
1) Panelfold.
2) Skyfold.
3) Hufcor Folding Panel Partitions.

2.2 PANEL CONSTRUCTION

A. Panel Dimensions: Standard panel dimension shall be a nominal 3" thick.

B. Panel Frame: Vertical steel frame members shall be minimum 18-gauge galvanneal steel, horizontal top cross member shall be minimum 12-gauge galvanneal steel, which meets or exceeds ASTM A 653 requirements. Frame shall be all-welded construction with steel corner supports and cross-bracing reinforcements. Panel frame shall be Class A rated in accordance with ASTM E 84.

C. Panel Skins: Panel skins shall be Class A rated (except Wood Veneer and High Pressure Laminate) in accordance with ASTM E 84. Panel skin material shall consist of (select): 1. Acoustical Substrate: consisting of structural acoustical substrate pressure laminated to both sides of the steel frame to form a rigid, unitized and structural panel.

D. Panel Hinges: Panel hinges shall be architectural grade, full leaf butt hinges. Hinges shall be attached to the steel frame of the panel(s) and reinforced with a steel backer plate.

E. Panel Weight: Maximum panel weight shall be 6.5 – 12.0 lb. / ft.2 depending on size and options selected.

F. STC Rating between 49-51. (AD-03)

2.3 OPERATION

A. Operation shall consist of an individual panel or panels hinged together in groups of two (2) and hinged to an adjustable jamb. Folding acoustical partitions shall be manually operated and capable of swinging 180o to allow sufficient clearance for the operable wall panels. One (1) folding acoustical partition panel shall contain a flush pull handle and surface mounted footbolt with strike plate.

2.4 FINISHES

A. Finish Material Type: Folding acoustical partition finish material shall be Class A (except wood veneer and high pressure laminate) rated in accordance with ASTM E 84, consisting of (select): 1. Vinyl: consisting of Type II, reinforced vinyl weighing 21 oz. / lin. yd. (651 g / lin. m). Vinyl shall meet or exceed CCC-W-408A and CFFA-W-101-D quality standards.
   1. Optional Upgrade Fabric: consisting of fade and tear resistant fabric that resists water-based stains weighing 13 oz. / lin. yd. (403 g / lin. m).

B. Finish Material Supplier: Finish material shall be Standard Factory Supplied: from manufacturer's standard selection of finish materials, as specified.

C. Finish Material Application: Finish material shall be Standard Factory Applied: by operable wall manufacturer.

2.5 PERIMETER TRIM AND SEALS

A. Vertical Trim and Seals: Panels shall have vertical astragals containing flexible vinyl seals and incorporate reversible tongue-and-groove-type configurations for positive interlocking with adjacent panels. Vertical astragal type shall be:
   1. Standard Trimless Astragal: consisting of an aluminum extrusion with tongue-and-groove-type vertical astragals. Vertical trim shall not be permitted on the panel faces, resulting in a minimal groove appearance between adjacent panels.

B. Horizontal Top Trim and Seals: Top seals shall consist of flexible vinyl sweep seals installed on both sides of the panel. The seals shall consist of a compressed bulb between two (2) fingers of vinyl. Top seal type shall be Fixed consisting of continuous-contact flexible vinyl, sealing against the folding acoustical partition header trim.

C. Horizontal Bottom Trim and Seals: Bottom seals shall consist of a single finger of flexible vinyl sweep seal installed on both sides of the panel. Bottom seal type shall be Fixed consisting of continuous-contact flexible vinyl, sealing against various floor surfaces.

2.6 FOLDING ACOUSTICAL PARTITION CLOSURES

A. Folding acoustical partition Types: Each folding acoustical partition configuration shall be hinged to an adjustable jamb consisting of an aluminum extrusion which is permanently mounted to a structural wall surface and is field-adjustable to compensate for out-of-plumb conditions of the fixed wall. The adjustable jamb shall incorporate a tongue-and-groove-type vertical astragal for positive interlocking with a folding acoustical partition panel. To stabilize the folding acoustical partition(s) a surface mounted footbolt shall be furnished by the operable wall manufacturer and installed by others in the field. The folding acoustical partition configuration shall be:
   1. Double Doors w/ Lap Trim: consisting of two (2) individual panels with each panel being hinged to an adjustable jamb. The lead edge of each panel shall contain a lap type extrusion that overlaps with the other one, creating a shiplap joint. (Note: This type of folding acoustical partition in normally used with a Model 2030 operable wall system utilizing a center type stack arrangement or Model 2020 remote stack unit.)

2.7 ACOUSTICAL PERFORMANCE

A. Certification: The folding acoustical partition(s) shall be of the same panel construction as the operable wall panels.

2.8 FOLDING ACOUSTICAL PARTITION ACCESSORY

A. Accessory includes Keyed Cylinder Lock with adjustable concealed vertical rod interfacing with strike plate attached to finished floor. Lock unit shall be capable of receiving a master cylinder, furnished by others and installed by the operable wall manufacturer as noted on submitted shop drawings.

PART 3 - EXECUTION

3.1 INSPECTION

A. Proper and complete preparation of the folding acoustical partition opening shall be by others in accordance with the architectural drawings, manufacturer’s shop drawings and ASTM E 557. Any deviation of the actual opening from these specifications shall be called to the attention of the architect prior to the installation of the folding acoustical partition(s).

B. Deficiencies in the folding acoustical partition opening shall be corrected by others prior to installation of the folding acoustical partition(s).

3.2 INSTALLATION

A. The folding acoustical partition(s) shall be installed by manufacturer’s authorized distributor.

B. The folding acoustical partition(s) shall be installed in accordance with manufacturer’s written instructions, shop drawings and ASTM E 557 installation guidelines.

3.3 ADJUSTING AND CLEANING

A. A. The folding acoustical partition(s) shall be adjusted and cleaned in accordance with manufacturer’s written instructions.

3.4 PROTECTION

A. The folding acoustical partition(s) shall be stored in the "extended" position prior to acceptance by the owner's representative.

3.5 DEMONSTRATION

A. The operable wall manufacturer’s authorized distributor shall demonstrate proper operation and explain proper and necessary maintenance requirements of the folding acoustical partition(s) to the owner's representative.

END OF SECTION 083513

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior storefront framing.
2. Storefront framing for punched openings.
3. Exterior manual-swing entrance doors and door-frame units.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples: For each exposed finish required.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Field quality-control reports.

D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.

d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

2. Entrance Doors:
a. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

H. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.

2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 15 as determined according to NFRC 500.

I. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 3.

1. Large-Missile Test: For glazed openings located within 30 feet of grade.

J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America as specified below or a comparable product by one of the following:
1. EFCO Corporation.
2. Kawneer North America; an Alcoa Company (Basis of Design).
    1) Product: 350 Standard Entrances.
3. United States Aluminum.
4. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
5. YKK AP America Inc.; Model 35D Medium Stile Door.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.
4. Finish: Baked-enamel or powder-coat finish.
5. Fabrication Method: Field-fabricated stick system.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

    a. Sheet and Plate: ASTM B 209.
    b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: As indicated.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbfto set the door in motion and not more than 15 lbf to open the door to its minimum required width.
b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

C. Operating Trim: BHMA A156.6.

2.6 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

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

B. Metal Protection:

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

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

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

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

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

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

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

END OF SECTION 084113

SECTION 085213 - METAL-CLAD WOOD WINDOWS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aluminum-Clad-Wood Windows.
   1. Double-hung windows.

1.2 REFERENCES

A. Window and Door Manufacturers Association (WDMA):
   1. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights (NAFS).
   2. WDMA I.S.4; Water Repellent Preservative Non-Pressure treatment for Millwork

B. National Fenestration Rating Council (NFRC):
   1. NFRC 100 - Procedure for Determining Fenestration Product U-Factors.
   2. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Submit shop drawings indicating details of construction, flashings and relationship with adjacent construction.

C. Selection Samples: For each factory-finished product specified, two complete sets of color chips representing manufacturer's full range of available finishes.

D. Verification Samples: For each factory-finished product specified, two samples, minimum size 6 inches (150 mm) square, representing actual finishes.

E. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 2 years installing similar assemblies.

B. Mock-Up: Provide a mock-up for evaluation of installation techniques and workmanship.

1. Mock-ups shall incorporate surrounding construction, including wall assembly fasteners, flashing, and other related accessories installed in accordance with manufacturer's approved installation methods.
2. Do not proceed with remaining work until workmanship is approved by Architect.
3. Modify mock-up as required to produce acceptable work.
4. At Substantial Completion, approved mockups may become part of completed work.
5. Demolish mockups and remove from site.

C. Pre-installation Meeting: Conduct pre-installation meeting on-site two weeks prior to commencement of installation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.

B. Deliver and store assembly materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact. Protect from damage.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by Manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.7 WARRANTY

A. Manufacturer's Standard Warranty: Assemblies will be free from defects in materials and workmanship from the date of manufacture for the time periods indicated below:
1. Window Units: 20 years.
2. Clad Finishes: 10 years against peeling, checking, cracking caulk or color change.
3. AAMA 2605 Clad Finishes: 20 years against peeling, checking, cracking or color change.
4. Glazing:
    a. Insulated Glass: 20 years against seal breakage.
    b. Laminated Glass: 5 years against delamination.
    c. Specialty Glazing: 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide the following:
1. Siteline Series aluminum-clad wood windows assemblies as manufactured by JELD-WEN, Inc., Charlotte, NC
    a. Window Type: Double-hung windows.

B. Alternate Manufacturers:
1. Andersen Windows, Bayport, MN.
2. Pella Corporation, Pella, IA.

2.2 ALUMINUM-CLAD-WOOD WINDOW ASSEMBLIES

A. Window Fabrication:
1. Window Type: Double-hung windows.
a. Frame: Head corner joints mechanically fastened over silicone injected nylon corner key. Sill corner joints sealed with foam gasket and screw boss construction.
b. Sash: Corner joints slot-and-tenoned, and mechanically fastened.
c. Glass: Mounted using silicone glazing compound and secured with interior applied profiled wood stops.
1) Glazing Bead: Traditional Beveled.
d. Sash Bottom Rail: Standard 2-1/4 inches (57.2 mm)

B. Frames:
1. Material: Select kiln-dried pine AuraLast treated wood.
2. Double-Hung Windows Base Frame: 4-9/16 inches (115 mm)
3. Jamb Width: 4-9/16 inches (116 mm).
4. Cladding: 0.050 inch (1.27 mm) extruded aluminum.

C. Sashes: Select kiln-dried pine AuraLast treated wood.
1. Sash Thickness: 1-7/16 inches (36.5 mm)
2. Cladding: 0.045 inch (1.2 mm) extruded aluminum.

D. Exterior Trim:
1. Nailing Fin and Drip Cap: Integral extruded aluminum on all four sides of frame.
2. As selected from Manufacturer's standard offering.
3. Casing, Standard: 2 inch (51 mm) brickmould.
4. Sill Nosing: Standard.

E. Weatherstripping:
1. Double-hung Windows: Dual bulb at head and sill, thermoplastic rubber bulb at check rail, rigid vinyl water stops at sill.
a. Concealed Jamb Track Color: Standard, Tan.

F. Window Hardware:
1. Double-Hung Windows:
a. Balance: Dual block and tackle.
b. Finish: As selected by Architect.

G. Glazing for Windows:
1. Strength: Standard annealed glass.
2. Strength: Tempered glass where indicated on plans.
3. Glazing Type: Insulated glass.
a. Description: Two panes of glass utilizing continuous roll formed stainless steel spacer and dual seal sealants.
b. Overall Nominal Thickness: 3/4 inch (19 mm).
c. Glass Coating: Standard, Low-E 366.

d. Glass Protection: Plastic preserve film on interior and exterior of glass.
e. Air Space: Standard Argon-filled airspace.

H. Exterior Insect Screens:
1. Material: Charcoal fiberglass screen cloth (18 by 16 mesh) set in painted roll formed aluminum frame.
2. Frame Color: Matched exterior cladding.

I. Grilles:
1. Type: Simulated Divided Lites (SDL).
a. Exterior Muntins:
1) Material: Extruded aluminum permanently applied to exterior of insulating glass unit.
2) Profiles: Bead stop profiles.
a) Profile Width: 2-5/16 inches (59mm) (for simulated double-hung checkrail).
3) Profiles: Putty profiles.
a) Profile Width: 1-1/8 inches (28.5 mm).
4) Pattern: As scheduled and indicated on Drawings.
5) Finish: Match exterior cladding.
b. Internal Shadow Bar:
1) Standard: Light Bronze.
c. Interior Spacer Bars:
1) Standard: Steel.
d. Interior Muntins:
1) Material: Clear pine permanently bonded to interior of insulating glass unit.
2) Profile: Beaded profile.

2.3 Flat Profile Width: 5/8 inch (15.9 mm).
a. Profile: Contour.
1) Contour Profile Width: 1 inch (25.4 mm).
b. Pattern: As scheduled and indicated on Drawings.
c. Finish: As selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Inspect and prepare openings and substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions.
1. Inspect assembly components prior to installation.
2. Verify rough opening conditions are within recommended tolerances.
3. Form sheet metal sill pan in accordance with manufacturer's recommendations.
4. Prepare assembly components for installation in accordance with manufacturer's recommendations.

B. Do not proceed with installation until openings and substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's

recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.2 INSTALLATION

A. Install assemblies in accordance with manufacturer's installation guidelines and recommendations including the following.

B. Installation of Windows With Nailing Fins: Insert windows into rough opening.
1. Shim side jambs straight.
2. Inspect window for square, level and plumb.
3. Fasten window through nailing fins around entire window.
4. Test and adjust for smooth operation of window.
5. Set all nails below wood surface.

3.3 FIELD QUALITY CONTROL

A. Manufacturers' Field Services: Perform field inspections as recommended by manufacturer.

3.4 CLEANING AND PROTECTION

A. Clean the exterior surface and glass with mild soap and water.

B. Protect installed windows from damage.

C. Remove and dispose of protective film from glass; touch-up, repair or replace damaged components and assemblies before Substantial Completion.

END OF SECTION 085213

SECTION 08 71 00 – DOOR HARDWARE

GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware for:

a. Swinging doors.

2. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section "Alternates" for alternates affecting this section.
2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
3. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.

1.03 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies

4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature

C. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.04 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.

B. Action Submittals:

1. Product Data: 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.
2. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.

    a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

    a. Door Index; include door number, heading number, and Architects hardware set number.
    b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
    c. Quantity, type, style, function, size, and finish of each hardware item.
    d. Name and manufacturer of each item.
    e. Fastenings and other pertinent information.
    f. Location of each hardware set cross-referenced to indications on Drawings.
    g. Explanation of all abbreviations, symbols, and codes contained in schedule.

h. Mounting locations for hardware.
i. Door and frame sizes and materials.
j. Name and phone number for local manufacturer's representative for each product.

4. Key Schedule:

a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
b. Use ANSI/BHMA A156.28 “Recommended Practices for Keying Systems” as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

f. Prepare key schedule by or under supervision of supplier, detailing Owner’s final keying instructions for locks.

5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product data for electrified door hardware:

a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

3. Certificates of Compliance:

a. UL listings for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in “QUALITY ASSURANCE” article, herein.

4. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.

c. Factory order acknowledgement numbers (for warranty and service)
d. Name, address, and phone number of local representative for each manufacturer.
e. Parts list for each product.
f. Final approved hardware schedule, edited to reflect conditions as-installed.
g. Final keying schedule
h. Copies of floor plans with keying nomenclature
i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.

1. Where products indicate “acceptable manufacturers” or “acceptable manufacturers and products”, provide product from specified manufacturers, subject to compliance with specified requirements and “Single Source Responsibility” requirements stated herein.

B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
2. Can provide installation and technical data to Architect and other related subcontractors.
3. Can inspect and verify components are in working order upon completion of installation.

D. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

E. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

F. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.

G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.

H. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.

1. Attendees: Owner, Contractor, Architect, Installer, Owner's security consultant, and Supplier's Architectural Hardware Consultant.
2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:

a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Address for delivery of keys.

I. Pre-installation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Review required testing, inspecting, and certifying procedures.

J. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.

a. Attendees: Door hardware supplier, door hardware installer, Contractor.
b. After the meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1. Deliver each article of hardware in manufacturer's original packaging.

C. Project Conditions:

1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
2. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.07 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Direct shipments not permitted, unless approved by Contractor.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

a. Closers:
1) Mechanical: 10 years

b. Exit Devices:
1) Mechanical: 3 years.

c. Locksets:
1) Mechanical: 3 years

d. Continuous Hinges: Lifetime warranty.
e. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.09 MAINTENANCE

A. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PRODUCTS

2.01 MANUFACTURERS

A. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

B. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. 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 including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when 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 thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series.
2. Acceptable Manufacturers and Products: Hager BB series, Stanley FBB Series.

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

    a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
    b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

    a. Exterior: Heavy weight, bronze/stainless steel, 4-1/2 inches (114 mm) high
    b. Interior: Heavy weight, steel, 4-1/2 inches (114 mm) high

4. 2 inches or thicker doors:

    a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
    b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

    a. Steel Hinges: Steel pins
    b. Non-Ferrous Hinges: Stainless steel pins
    c. Out-Swinging Exterior Doors: Non-removable pins
    d. Out-Swinging Interior Lockable Doors: Non-removable pins
    e. Interior Non-lockable Doors: Non-rising pins

7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.

2.04 CONTINUOUS HINGES

A. Aluminum Geared

1. Manufacturers:

    a. Scheduled Manufacturer: Ives.
    b. Acceptable Manufacturers: Select, Stanley.

2. Requirements:

    a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
    b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
    c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
    d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
    e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.

f. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
g. Install hinges with fasteners supplied by manufacturer.
h. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, ABH.

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.06 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage L9000 series.
2. Acceptable Manufacturers and Products: Sargent 8200 series, Falcon MA series.

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3 hour fire doors.
2. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
3. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to “KEYING” article, herein.
4. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
5. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
6. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

a. Lever Design: Schlage Latitude (LAT).

2.07 ALUMINUM DOOR LOCKS – NARROW STYLE

A. Manufacturer and Product:

1. Scheduled Manufacturer and Product: Adams Rite 4900 series x 4590/1 Paddle.
2. Acceptable Manufacturers and Products: No Substitute.

B. Requirements:

1. Provide narrow style aluminum door locks as specified. Cylinders: Refer to “KEYING” article, herein.
2. Provide locks with necessary backset as required for door detail with full 5/8 inch (16 mm) throw latchbolt.
3. Provide manufacturer’s standard strikes unless extended lip strikes are necessary to protect trim.

2.08 AUXILIARY LOCKS

A. Aluminum Door Deadbolt - Narrow Style:

1. Manufacturers and Products:

a. Scheduled Manufacturer and Product: Adams Rite MS1950 Series.
b. Acceptable Manufacturers and Products: No Substitute.

2. Requirements:

a. Provide narrow style aluminum door deadbolts as specified.
b. Cylinders: Refer to “KEYING” article, herein.
c. Provide deadbolts with necessary backset with full 1-13/32 inches (36 mm) throw deadbolt.
d. Provide manufacturer’s standard strikes unless extended lip strikes are necessary to protect trim.

2.09 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Falcon 25 series.
2. Acceptable Manufacturers and Products: Sargent 19-43-GL-80 series, Von Duprin 98 series.

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.

5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide flush end caps for exit devices.
7. Provide exit devices with manufacturer's approved strikes.
8. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
9. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
10. Provide cylinder dogging as specified at non fire-rated openings.
11. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.10 ELECTRIC STRIKES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 6000 Series.
2. Acceptable Manufacturers and Products: Folger Adam 300 Series, HES 1006 Series.

B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary-resistant.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.11 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage small-format interchangeable core.
2. Acceptable Manufacturers and Products: Best (Owner Preferred), Falcon.

B. Requirements:

1. Provide cylinders/cores, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.

   a. Conventional Patented Restricted: cylinder with interchangeable core with patented, restricted keyway.

3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent-protected.
4. Nickel silver bottom pins.

C. Construction Keying:

1. Replaceable Construction Cores

a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
1) 3 construction control keys
2) 12 construction change (day) keys.

b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.12 KEYING

A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Provide cylinders/cores keyed into Owner's existing factory registered Best keying system.

C. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

D. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.

a. Master Keying system as directed by the Owner.

2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:

a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
b. Patent Protection: Keys and blanks protected by one or more utility patent(s).

4. Identification:

a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Do not provide blind code marks with actual key cuts.
b. Identification stamping provisions must be approved by the Architect and Owner.
c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
d. Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.

    a. Change (Day) Keys: 3 per cylinder/core.
    b. Permanent Control Keys: 3.
    c. Master Keys: 6.

2.13 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer: Telkee.
2. Acceptable Manufacturers: HPC, Lund.

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

    a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
    b. Provide hinged-panel type cabinet for wall mounting.

2.14 KEY MANAGEMENT SOFTWARE

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage SITEMASTER 200.
2. Acceptable Manufacturers and Products: Best Keystone 600N, Sargent KeyWizard.

B. Requirements:

1. Software: Provide tracking, issuing, collecting and transferring information regarding keys. Provide customized query, reporting, searching capability, comprehensive location hardware listings, display key holder photos and signature for verification, and provide automatic reminders for maintenance, back-ups and overdue keys.
2. Provide training for Owner’s personnel on proper operation and application of key management software.

2.15 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Falcon SC70A series.
2. Acceptable Manufacturers and Products: LCN 4050 series, Norton 7500 series.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with aluminum cylinder.
3. Closer Body: 1-1/2 inch (38 mm) diameter with 5/8 inch (16 mm) diameter heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.16 MAGNETIC LOCKS

A. Magnetic Locks – Surface Type:

1. Manufacturers and Products:

   a. Scheduled Manufacturer and Product: Schlage M490 series.
   b. Acceptable Manufacturers and Products: Dynalock 3000 series, Security Door Controls 1510 series.

2. Requirements:

   a. Provide magnetic locks certified to meet ANSI/BHMA A156.23 classification criteria including minimum holding force of 1500 LBF. Provide magnetic locks equipped with SPDT Magnetic Bond Sensing device, where specified, to monitor whether sufficient magnetic holding force exists to ensure adequate locking and SPDT Door Status Monitor device, where specified, to monitor whether door is open or closed. Provide bond sensors fully concealed within electromagnet to resist tampering or damage.
   b. Provide magnetic locks certified to meet UL10C, and UL1034 for burglary-resistant electronic locking mechanisms.
   c. Provide fasteners, mounting brackets, and spacer bars required for mounting and details.
   d. Provide power supply recommended and approved by manufacturer of magnetic locks.
   e. Where magnetic locks are scheduled, provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of magnetic locks for each individual leaf. Switches control both doors simultaneously at pairs. Locate controls as directed by Architect.

2.17 PASSIVE INFRARED MOTION SENSORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage SCAN II Series.
2. Acceptable Manufacturers and Products: RCI 915 Series, Security Door Controls MD-31D Series.

B. Requirements:

1. Provide motion sensors as specified in hardware groups.

2.18 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Hiawatha.

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

2.19 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Hiawatha.

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.

2. Sizes of plates:

    a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
    b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.20 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson.
2. Acceptable Manufacturers: Rixson, Sargent.

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.21 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, ABH.

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.22 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International.

2. Acceptable Manufacturers: National Guard, Reese.

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:

a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width

3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.23 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Steelcraft, Republic.

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.24 LATCH PROTECTORS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Don-Jo.

B. Provide stainless steel latch protectors of type required to function with specified lock.

2.25 COAT HOOKS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Provide coat hooks as specified.

2.26 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent.

H. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying section.

I. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

K. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

L. Stops: Provide wall stops for doors unless overhead or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

M. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

N. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

O. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer's Architectural Hardware Consultant must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, and door hardware.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DEMONSTRATION

A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.07 DOOR HARDWARE SCHEDULE

A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

B. Hardware Sets:

HARDWARE GROUP NO. 01

Provide each CO door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR

CASED OPENING - NO HARDWARE REQUIRED.

HARDWARE GROUP NO. 02

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 LATA	626	SCH
1	EA	OH STOP	450S	630	GLY

HARDWARE GROUP NO. 03

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 LATA	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA36" (914MM)	AA	ZER
1	EA	THRESHOLD	63A-223	A	ZER

HARDWARE GROUP NO. 04

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050BDC LATA	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	COAT AND HAT HOOK	507	626	IVE

HARDWARE GROUP NO. 05

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050BDC LATA	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	OH STOP	450S	630	GLY
1	EA	COAT AND HAT HOOK	507	626	IVE

HARDWARE GROUP NO. 05.1

Provide each PD door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	POCKET DR FRAME	TYPE C (2-0 TO 3-0 & 6-8 TO 7-0)		KNC
1	EA	POCKET DOOR LOCK	2002CPDL x S2002C x S2002T	626	ACC
1	EA	SFIC MORTISE CYL.	80-110	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES

HARDWARE GROUP NO. 06

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC LATA	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE GROUP NO. 08

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC LATA	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	OH STOP	450S	630	GLY

HARDWARE GROUP NO. 09

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080BDC LATA	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE GROUP NO. 10

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	L9080BDC LATA	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE GROUP NO. 11

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW8	652	IVE
1	EA	EU MORTISE LOCK	L9092BDCEU LATA RX CON 12/24 VDC	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	SURFACE CLOSER	SC71A DS	689	FAL
3	EA	SILENCER	SR64	GRY	IVE
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 BBK KL900 120/240 VAC	LGR	SCE
1	SET	WIRING DIAGRAMS	DOOR ELEVATION AND POINT-TO-POINT		SCE
1			CARD READER BY OTHERS		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. AUTHORIZED ACCESS BY KEY OR VALID CREDENTIAL WHICH SHUNTS DOOR POSITION SWITCH AND TEMPORARILY UNLOCKS OUTSIDE LEVER. INSIDE LEVER ALWAYS FREE FOR EGRESS. SWITCH IN INSIDE LEVER SHUNTS DOOR POSITION SWITCH FOR REQUEST TO EXIT (REX).

HARDWARE GROUP NO. 12

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	L9080BDC LATA	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	OH STOP	450S	630	GLY
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA36" (914MM)	AA	ZER
1	EA	THRESHOLD	63A-223	A	ZER

HARDWARE GROUP NO. 13

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
2	EA	MANUAL FLUSH BOLT	FB457 24"	626	IVE
1	EA	DUST PROOF STRIKE	DP1	626	IVE
1	EA	CLASSROOM LOCK	L9070BDC LATA	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
2	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE GROUP NO. 14

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	L9040 LATA L283-722	626	SCH
1	EA	SURFACE CLOSER	SC71A REG OR PA AS REQ	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	SINGLE HOOK	507B	626	IVE

HARDWARE GROUP NO. 15

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC LATA	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	SURFACE CLOSER	SC71A REG OR PA AS REQ	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE GROUP NO. 16

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	DEADBOLT	MS1850S	628	ADA
1	EA	MORTISE CYL TURN	09-900 118 36-083	626	SCH
1	EA	SFIC MORTISE CYL.	80-138 X L583-255 36-083	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	PUSH/PULL BAR	9190HD-10"-NO	630	IVE
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	SC71A REG OR PA AS REQ	689	FAL

HARDWARE GROUP NO. 17

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC LATA	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	SURFACE CLOSER	SC71A FA/HO	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE GROUP NO. 18

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	L9080BDC LATA	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	SURFACE CLOSER	SC71A DSHO	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER

HARDWARE GROUP NO. 19

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9080BDC LATA	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	OH STOP	450S	630	GLY

HARDWARE GROUP NO. 20

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224HD EPT	628	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	RX-MEL-25-R-NL-CON 24 VDC	626	FAL
1	EA	SFIC RIM CYLINDER	80-159	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	SC71A HDPA	689	FAL
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS KL900	LGR	SCE
1	SET	WIRING DIAGRAMS	DOOR ELEVATION AND POINT-TO-POINT		SCE
1			CARD READER BY OTHERS		
1			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. AUTHORIZED ACCESS BY VALID CREDENTIAL WHICH SHUNTS DOOR POSITION SWITCH AND RETRACTS EXIT DEVICE LATCHBOLT, ALLOWING DOOR TO BE PULLED OPEN. IMMEDIATE EGRESS ALWAYS ALLOWED. SWITCH IN PUSH RAILS SHUNT DOOR POSITION SWITCH FOR REQUEST TO EXIT (REX). DOOR CAN BE ELECTRICALLY DOGGED TO ALLOW FREE ACCESS.

HARDWARE GROUP NO. 21

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	MAGNETIC LOCK	M492P ATS/LED-2 12/24 VDC	628	SCE
2	EA	PUSH/PULL BAR	9190HD-10"-NO	630	IVE
2	EA	SURFACE CLOSER	SC71A REG OR PA AS REQ	689	FAL
2	EA	WALL STOP/HOLDER	WS40	626	IVE
1	EA	EMERG. RELEASE SWITCH	623RDEX 12/24 VDC	630	SCE
2	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	MOTION SENSOR	SCANII 12/24 VDC	WHT	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS FA900 KL900 120/240 VAC	LGR	SCE
1	SET	WIRING DIAGRAMS	DOOR ELEVATION AND POINT-TO-POINT		SCE
1			CARD READER BY OTHERS		
1			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER		

NOTE: MOUNT DOOR CLOSERS REGULAR ARM TO ALLOW 180 DEGREE OPENING.
OPERATIONAL DESCRIPTION: DOORS NORMALLY CLOSED AND LOCKED MAGNETICALLY. AUTHORIZED ACCESS BY VALID CREDENTIAL, WHICH SHUNTS DOOR POSITION SWITCHES AND RELEASES MAGNETIC LOCKS, ALLOWING DOORS TO BE PUSHED OPEN. IMMEDIATE EGRESS ALWAYS ALLOWED BY MOTION SENSOR, WHICH SHUNTS DOOR POSITION SWITCHES AND RELEASES MAGNETIC LOCKS, ALLOWING DOORS TO BE PULLED OPEN. AUXILIARY PUSH BUTTON RELEASES MAGNETIC LOCKS FOR EXITING, PER CODE REQUIREMENTS. LOSS OF POWER OR FIRE ALARM RELEASES MAGNETIC LOCKS (FAIL-SAFE).

HARDWARE GROUP NO. 22

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224HD	628	IVE
1	EA	DEADLATCH	4911W	628	ADA
1	EA	PULL PADDLE	4591-0X-00	628	ADA
1	EA	SFIC MORTISE CYL.	80-138 X L583-255 36-083	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	ELECTRIC STRIKE	6211AL FSE CON	630	VON
1	EA	LOCK GUARD	LG14	630	IVE
1	EA	PUSH/PULL BAR	9190HD-10"-NO	630	IVE
1	EA	SURFACE CLOSER	SC71A DS	689	FAL
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	MOTION SENSOR	SCANII 12/24 VDC	BLK	SCE
1	EA	POWER SUPPLY	PS902 BBK KL900 120/240 VAC	LGR	SCE
1	SET	WIRING DIAGRAMS	DOOR ELEVATION AND POINT-TO-POINT		SCE
1			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. AUTHORIZED ACCESS BY VALID CREDENTIAL WHICH SHUNTS DOOR POSITION SWITCH AND TEMPORARILY RELEASES ELECTRIC STRIKE, ALLOWING DOOR TO BE PULLED OPEN. IMMEDIATE EGRESS ALWAYS ALLOWED BY DEPRESSING INSIDE PADDLE TO RETRACT LATCH. INSIDE MOTION SENSOR SHUNTS DOOR POSITION SWITCH FOR REQEST TO EXIT (REX).

HARDWARE GROUP NO. 23

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224HD	628	IVE
1	EA	PANIC HARDWARE	CD-25-C-DT	626	FAL
1	EA	PANIC HARDWARE	CD-25-C-NL	626	FAL
2	EA	SFIC MORTISE CYL.	80-138 X L583-255 36-083	626	SCH
1	EA	SFIC RIM CYLINDER	80-159	626	SCH
3	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
2	EA	OH STOP	100S	630	GLY
2	EA	SURFACE CLOSER	SC71A HDPA	689	FAL
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER		

OPERATIONAL DESCRIPTION: DOORS NORMALLY CLOSED AND LOCKED. AUTHORIZED ACCESS BY VALID CREDENTIAL WHICH SHUNTS DOOR POSITION SWITCHES AND RETRACTS EXIT DEVICE LATCHBOLTS, ALLOWING DOORS TO BE PULLED OPEN. IMMEDIATE EGRESS ALWAYS ALLOWED. SWITCHES IN PUSH RAILS SHUNT DOOR POSITION SWITCHES FOR REQUEST TO EXIT (REX). DOORS CAN BE ELECTRICALLY DOGGED TO ALLOW FREE ACCESS.

HARDWARE GROUP NO. 24

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW8	652	IVE
1	EA	EU MORTISE LOCK	L9092BDCEU LATA RX CON 12/24 VDC	626	SCH
1	EA	PERM. CYLINDER CORE	AS REQUIRED	626	BES
1	EA	OH STOP	450S	630	GLY
1	EA	SURFACE CLOSER	SC71A REG OR PA AS REQ	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 BBK KL900 120/240 VAC	LGR	SCE
1	SET	WIRING DIAGRAMS	DOOR ELEVATION AND POINT-TO-POINT		SCE
1			CARD READER BY OTHERS		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. AUTHORIZED ACCESS BY KEY OR VALID CREDENTIAL WHICH SHUNTS DOOR POSITION SWITCH AND TEMPORARILY UNLOCKS OUTSIDE LEVER. INSIDE LEVER ALWAYS FREE FOR EGRESS. SWITCH IN INSIDE LEVER SHUNTS DOOR POSITION SWITCH FOR REQUEST TO EXIT (REX).

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Glass for doors and storefront framing.
2. Glazing sealants and accessories.

1.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction adhesion and compatibility test report.

1.5 QUALITY ASSURANCE

A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings.

C. Windborne-Debris-Impact Resistance: Exterior glazing shall comply with basic-protection testing requirements in ASTM E 1996 for Wind Zone 3 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.

1. Large-Missile Test: For glazing located within 30 feet of grade.
2. Small-Missile Test: For glazing located more than 30 feet above grade.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS, GENERAL

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

1. GANA Publications: "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.4 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer, ionomeric polymer interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with one of the following to comply with interlayer manufacturer's written instructions:

1. Polyvinyl butyral interlayer.
2. Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
3. Ionomeric polymer interlayer.
4. Cast-in-place and cured-transparent-resin interlayer.
5. Cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seals.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. 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.

3.3 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.4 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.

3.5 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

3.6 INSULATING GLASS SCHEDULE

A. Glass Type : Low-E-coated, clear insulating glass.
1. Overall Unit Thickness: 1 inch.
2. Minimum Thickness of Each Glass Lite: 3 mm.
3. Outdoor Lite: Ultraclear fully tempered float glass.
4. Interspace Content: Air.
5. Indoor Lite: Annealed float glass.
6. Low-E Coating: Pyrolytic or sputtered on second or third surface.
7. See minimum requirements on COMCheck model provided on drawings for the following:
   a. Winter Nighttime U-Factor.
   b. Summer Daytime U-Factor.
   c. Visible Light Transmittance.
   d. Solar Heat Gain Coefficient.
8. Safety glazing required.

END OF SECTION 088000

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fixed, extruded-aluminum and formed-metal louvers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

C. Samples: For each type of metal finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on tests performed according to AMCA 500-L.

B. Windborne-debris-impact-resistance test reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Windborne-Debris-Impact Resistance: Louvers located within 30 feet of grade shall pass basic-protection, large-missile testing requirements in ASTM E 1996 for Wind Zone 3 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than louvers indicated for use on Project.

C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

2.2 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Wind-Driven-Rain-Resistant Louver:

1. Louver Depth: 4 inches.
2. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.
3. Louver Performance Ratings:

    a. Free Area: Not less than 5.0 sq. ft. for 48-inch-wide by 48-inch-high louver.
    b. Air Performance: Not more than 0.10-inch wg static pressure drop at 600-fpm free-area intake velocity.
    c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 inches per hour and a wind speed of 29 mph at a core-area intake velocity of 300 fpm.

4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.3 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening.

B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.

2.4 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
4. For fastening stainless steel, use 300 series stainless-steel fasteners.
5. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.2 ADJUSTING

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

END OF SECTION 089119

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each texture finish indicated on same backing indicated for Work.

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.

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. Gypsum Board, Type X: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
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. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

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. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2.

D. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through

perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C 840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. 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.

E. Prefill open joints and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. 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 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.2 PROTECTION

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

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Porcelain tile.
   2. Tile backing panels.
   3. Crack isolation membrane.
   4. Metal edge strips.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:

   1. Each type and composition of tile and for each color and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, Type A.
   1. Thickness: 5/8 inch.

2.3 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch nominal thickness.

C. PVC Sheet: PVC heat-fused on both sides to facings of nonwoven polyester; 0.040-inch nominal thickness.

D. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.

E. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch nominal thickness.

F. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch nominal thickness.

G. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.

H. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

I. Latex-Portland Cement Crack-Resistant Mortar: Flexible mortar consisting of cement-based mix and latex additive.

J. Crack Isolation Membrane and Tile-Setting Adhesive: One-part, fluid-applied product intended for use as both a crack isolation membrane and tile-setting adhesive in a two-step process.

2.4 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

B. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
   1. For wall applications, provide nonsagging mortar.

2.5 GROUT MATERIALS

A. Standard Cement Grout: ANSI A118.6.

2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

C. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    a. Tile floors consisting of tiles 8 by 8 inches or larger.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
1. Porcelain Tile: minimum recommended by Manufacturer.

H. Metal Edge Strips: Install at locations indicated and where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

I. Floor Sealer: Apply floor sealer to grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

J. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Ceramic Tile Installation: TCNA F115; thinset mortar; epoxy grout.

a. Thinset Mortar: Standard dry-set mortar.
b. Grout: Water-cleanable epoxy grout.

B. Interior Wall Installations, Wood or Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units or fiber-cement backer board.
   a. Thinset Mortar: Standard dry-set mortar.
   b. Grout: Water-cleanable epoxy grout.

END OF SECTION 093013

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Delegated-Design Submittal: For seismic restraints for ceiling systems.

1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Product test reports.

C. Research reports.

D. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for ceiling systems.

B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class C according to ASTM E 1264.
2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL PANELS

A. Acoustical Panel Standard: Manufacturer's standard panels according to ASTM E 1264.

2.3 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Hold-Down Clips: Manufacturer's standard hold-down.

C. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

D. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

2.5 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

PART 3 - EXECUTION

3.1 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.

B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.

B. 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. Do not use exposed fasteners, including pop rivets, on moldings and trim.
3. Arrange directionally patterned acoustical panels as follows:

a. As indicated on reflected ceiling plans.

END OF SECTION 095113

SECTION 095423 - LINEAR METAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes strip, linear metal pans and suspension systems for ceilings.

1.2 COORDINATION

A. Coordinate layout and installation of linear metal pans and suspension system with other construction that penetrates ceilings or is supported by them.

1.3 ACTION SUBMITTALS

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

B. Samples: For each exposed finish.

C. Delegated-Design Submittal: For seismic restraints for ceiling systems.

1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Drawn to scale and coordinating and showing the following:

1. Linear pattern.
2. Joint pattern.
3. Ceiling suspension members.
4. Method of attaching hangers to building structure.
5. Ceiling-mounted items.
6. Ceiling perimeter and penetrations through ceiling; trim and moldings.

B. Product test reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver linear metal pans, suspension system components, and accessories in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Handle linear metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install linear metal ceilings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 450 or less.

B. Delegated Design: Engage a qualified professional engineer to design seismic restraints for ceiling systems.

C. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 0-2."

2.2 ALUMINUM PANS AND SUSPENSION SYSTEM FOR LINEAR METAL CEILING

A. Aluminum Pans and Suspension System **(LMC-1)**:

1. Basis of Design and Comparable Manufacturers: As indicated on Finish Legend.
2. Pattern: Perforation pattern as selected by Architect.
3. Width: 7-1/4 inches.
4. Color: Wood-look finish as selected by Architect from manufacturer's full range.

B. Panel Length: Manufacturer's standard.

C. Suspension-System Main-Carrier Material: Hot-dip galvanized steel, factory painted.

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

2.3 LINEAR METAL CEILING PANS

A. Acoustical Metal Pan Standard: Provide manufacturer's standard linear metal pans of

configuration indicated that comply with ASTM E 1264.

1. Mounting Method for Measuring NRC: Type E-400.

B. Sheet Metal Characteristics: For metal components 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, roughness, stains, or discolorations.

1. Aluminum Sheet: Roll-formed aluminum sheet, complying with ASTM B 209; alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated to snap on and be securely retained on carriers without separate fasteners, and finished to comply with requirements indicated.

D. Pan Splices: Construction same as pans, in lengths 8 to 12 inches; with manufacturer's standard finish.

E. End Caps: Metal matching pans; fabricated to fit and conceal exposed ends of pans.

F. Moldings and Trim: Provide manufacturer's standard moldings and trim for exposed members, and as indicated or required, for edges and penetrations of ceiling, around fixtures, at changes in ceiling height, and for other conditions; of same metal and finish as linear metal ceiling pans.

G. Sound-Absorbent Fabric Layer: Provide fabric layer, sized to fit concealed surface of pan, and consisting of black, nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing according to ASTM E 84.

1. Bond fabric layer to panels in the factory with manufacturer's standard nonflammable adhesive.

H. Sound-Absorbent Pads: Provide width and length to completely fill concealed surface of pan, with surface- burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing according to ASTM E 84, and to comply with the following requirements:

1. Plastic Sheet-Wrapped, Mineral-Fiber Insulation: Pads consisting of nonrigid, PVC plastic sheet encapsulating unfaced mineral-fiber insulation complying with ASTM C 553, Type I, Type II, or Type III, and as follows:

a. Mineral-Fiber Type and Thickness: Glass fiber; 1 inch.

2.4 METAL SUSPENSION SYSTEMS

A. Metal Suspension Systems Standard: Provide ceiling manufacturer's standard metal suspension systems of types and finishes indicated that comply with applicable ASTM C 635/C 635M requirements.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, Direct Hung, unless otherwise indicated.

1. Postinstalled Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction,

as determined by testing per ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC service condition (mild).

C. Wire Hangers, Braces, and Ties: Zinc-Coated Carbon-Steel Wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper

1. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C 635/C 635M, Table 1, Direct Hung is less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

D. Carriers: Factory finished.

1. Main Carriers: Steel, not less than 0.0209-inch nominal thickness, cold-rolled sheet, with factory- applied protective coating, complying with ASTM C 635/C 635M.
2. Color: As selected by Architect from manufacturer's full range.

E. Carrier Splices: Same metal, profile, and finish as for carriers.

F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical metal pans in place.

I. Hold-Down Clips: Manufacturer's standard hold-down clips spaced to secure acoustical metal pans in place to molding and trim at perimeter.

J. Edge Moldings and Trim: Provide exposed members as indicated or required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of penetrations through ceiling, to conceal ends of pans and carriers, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching linear metal pans or extruded plastic unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which linear metal ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of linear metal ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of linear metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and on Coordination Drawings.

3.3 INSTALLATION

A. Comply with ASTM C 636/C 636M, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

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.
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, install trapezes or equivalent devices.
4. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to postinstalled mechanical or adhesive anchors.
5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
6. Do not attach hangers to steel deck tabs or to steel roof deck.

C. Install edge moldings and trim of type indicated at perimeter of linear metal ceiling area and where necessary to conceal edges and ends of linear metal pans.

1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

D. Install suspension system carriers so they are aligned and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Cut linear metal pans for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.

F. Install linear metal pans in coordination with suspension system and exposed moldings and trim.

1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
2. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
3. Install pans with butt joints using internal pan splices and in the following joint configuration:

    a. Aligned.
    b. Aligned, every other pan length.
    c. Staggered a minimum of 12 inches.
    d. Random.
    e. As indicated.

4. Where metal pan ends are visible, install end caps unless trim is indicated.

END OF SECTION 095423

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vinyl base.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 VINYL BASE

A. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).

   1. Group: I (solid, homogeneous).
   2. Style and Location:
      a. Style A, Cove: .

B. Minimum Thickness: 0.125 inch.

C. Height: 4 inches.

D. Lengths: Coils in manufacturer's standard length.

E. Outside Corners: Preformed.

F. Inside Corners: Job formed.

G. Colors and Patterns: As indicated on finish schedule..

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Preformed Corners: Install preformed corners before installing straight pieces.

G. Job-Formed Corners:

1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Miter or cope corners to minimize open joints.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Luxury vinyl floor tile.
   2. Vinyl composition floor tile.
   3. Static dissipative floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full-size units of each color and pattern of floor tile required.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURY VINYL FLOOR TILE

A. Tile Standard: ASTM F 1700, Class 2, through pattern.

B. Wearing Surface: Smooth.

C. Thickness: 0.125 inch.

D. Size: 18 by 18 inches.

E. Color and Patterns: As selected by Architect from full range of industry colors.

2.3 VINYL COMPOSITION FLOOR TILE

A. Tile Standard: ASTM F 1066, Class 2, through pattern.

B. Wearing Surface: Smooth.

C. Thickness: 0.125 inch.

D. Size: 12 by 12 inches.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 STATIC DISSIPATIVE FLOOR TILE

A. Tile Standard: ASTM F 1066 tile, Class 2, through pattern.

B. Wearing Surface: Smooth.

C. Thickness: 0.125 inch.

D. Size: 12 by 12 inches.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

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

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply one coat(s).

C. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096816 - SHEET CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Woven carpet.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For carpet installation, showing the following:

   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
   2. Carpet type, color, and dye lot.
   3. Seam locations, types, and methods.
   4. Types, colors, and locations of edge, transition, and other accessory strips.
   5. Transition details to other flooring materials.

C. Samples: For each exposed product and for each color and texture required.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 WARRANTY

A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

   1. Warranty Period: 10 years from date of Substantial Completion.

2.

PART 2 - PRODUCTS

2.1 WOVEN CARPET

A. Product: As indicated on finish schedule.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Concrete Slabs:

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    c. Perform additional moisture tests recommended in writing by adhesive and carpet manufacturers. Proceed with installation only after substrates pass testing.

B. Wood Subfloors: Verify that underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

3.2 PREPARATION

A. General: Comply with CRI's "CRI Carpet Installation Standard" and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 CARPET INSTALLATION

A. Comply with CRI's "CRI Carpet Installation Standard" and carpet manufacturer's written installation instructions for the following:

1. Direct-glue-down installation.
2. Double-glue-down installation.
3. Carpet with attached-cushion installation.
4. Preapplied adhesive installation.
5. Hook-and-loop installation.
6. Stretch-in installation.
7. Stair installation.

B. Comply with carpet manufacturer's written instructions and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

1. Stretch-in Carpet Installation: Install carpet cushion seams at 90-degree angle with carpet seams.

C. Install pattern parallel to walls and borders.

D. Install borders with mitered corner seams.

E. Do not bridge building expansion joints with carpet.

F. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

G. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

H. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

I. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION 096816

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on exterior substrates.

1.2 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples: For each type of paint system and each color and gloss of topcoat.

C. Product List: For each product indicated. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

D. Colors: As indicated on Drawings.

1. 10 percent of surface area will be painted with deep tones.

2.3 PRIMERS/SEALERS

A. Primer, Alkali Resistant, Water Based: MPI #3.

B. Primer, Bonding, Water Based: MPI #17.

C. Primer, Bonding, Solvent Based: MPI #69.

D. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.

2.4 METAL PRIMERS

A. Primer, Alkyd, Anti-Corrosive for Metal: MPI #79.

B. Primer, Alkyd, Quick Dry, for Metal: MPI #76.

C. Primer, Galvanized, Water Based: MPI #134.

D. Primer, Galvanized: As recommended in writing by topcoat manufacturer.

E. Primer, Quick Dry, for Aluminum: MPI #95.

2.5 WOOD PRIMERS

A. Primer, Latex for Exterior Wood: MPI #6.

B. Primer, Alkyd for Exterior Wood: MPI #5.

C. Primer, Oil for Exterior Wood: MPI #7.

2.6 WATER-BASED PAINTS

A. Latex, Exterior Flat (Gloss Level 1): MPI #10.

B. Latex, Exterior Semi-Gloss (Gloss Level 5): MPI #11.

C. Latex, Exterior, Gloss (Gloss Level 6: MPI #119.

D. Light Industrial Coating, Exterior, Water Based (Gloss Level 3): MPI #161.

E. Light Industrial Coating, Exterior, Water Based, Semi-Gloss (Gloss Level 5): MPI #163.

F. Light Industrial Coating, Exterior, Water Based, Gloss (Gloss Level 6): MPI #164.

2.7 ACRYLIC ELASTOMERIC MASONRY COATING SYSTEMS

A. Prime Coat: Clear Masonry Sealer
   1. Sherwin-Williams: Loxon clear masonry primer/sealer, LX02W0050.
   2. GAF: Masonex clear sealer.
   3. Dulux: Perma-Crete clear sealer.

B. Intermediate Coat: Exterior Acrylic Elastomeric Coating
   1. Sherwin-Williams: SherLastic 100% acrylic elastomeric coating; A05W00651. Smooth texture, flat finish.

C. Topcoat: Exterior Acrylic Elastomeric Coating
   1. Sherwin-Williams: SherLastic 100% acrylic elastomeric coating; A05W00651. Smooth texture, flat finish. Architect to select finish color from manufacturer’s full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

   1. Concrete: 12 percent.
   2. Masonry (Clay and CMU): 12 percent.
   3. Wood: 15 percent.
   4. Portland Cement Plaster: 12 percent.
   5. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

B. 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.

3.4 CLEANING AND PROTECTION

A. 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.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:

1. Latex Floor Paint System:

a. Prime Coat: Floor paint, latex, low gloss (maximum Gloss Level 3), MPI #60.
b. Intermediate Coat: Floor paint, latex, low gloss (maximum Gloss Level 3), MPI #60.
c. Topcoat: Floor paint, latex, low gloss (maximum Gloss Level 3), MPI #60.

B. Steel Substrates:

1. Quick-Drying Enamel System:

a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.
b. Intermediate Coat: Alkyd, quick dry, matching topcoat.
c. Topcoat: Alkyd, quick dry, semi-gloss (Gloss Level 5), MPI #81.
d. Topcoat: Alkyd, quick dry, gloss (Gloss Level 7), MPI #96.

C. Galvanized-Metal Substrates:

1. Latex System:

a. Prime Coat: Primer, galvanized, water based, MPI #134.
b. Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
c. Intermediate Coat: Latex, exterior, matching topcoat.
d. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.

D. Wood and Fiber Cement Substrates: Including trim and siding.

1. Latex System:

a. Prime Coat: Primer, latex for exterior wood, MPI #6.
b. Intermediate Coat: Latex, exterior, matching topcoat.

c. Topcoat: Latex, exterior flat (Gloss Level 1), MPI #10 for siding
d. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11 for trim.

E. Plastic Trim Fabrication Substrates:

1. Latex System:

a. Prime Coat: Primer, bonding, water based, MPI #17.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

1.2 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples: For each type of paint system and in each color and gloss of topcoat.

C. Product List: For each product indicated. Include printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.

8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

D. Colors: As indicated on the Drawings.

1. 10 percent of surface area will be painted with deep tones.

2.3 PRIMERS/SEALERS

A. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149.

B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.4 METAL PRIMERS

A. Primer, Rust-Inhibitive, Water Based: MPI #107.

2.5 WATER-BASED PAINTS

A. Latex, Interior, Institutional Low Odor/VOC, Flat (Gloss Level 1): MPI #143. for walls and ceilings.

B. Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss (Gloss Level 5): MPI #147. for trim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.
5. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

B. 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.

3.4 CLEANING AND PROTECTION

A. 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.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, rust-inhibitive, water based MPI #107.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5), MPI #147.

B. Wood and MDF Substrates: Including trim, architectural woodwork, doors, windows, and wood-based panel products. Caulk and sand coplanar surfaces to provide continuous appearance.

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, latex, for interior wood, MPI #39.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5), MPI #147.

C. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, flat (Gloss Level 1), MPI #143.

END OF SECTION 099123

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and application of wood finishes.

1.2 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

D. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

E. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

B. Samples: For each type of finish system and in each color and gloss of finish indicated.

C. Product List: For each product indicated, include printout of current "MPI Approved Products List" for each product category specified in Part 2, with the product proposed for use highlighted.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each finish system indicated and each color 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 type of finish system and substrate.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Architect will designate items or areas required.

2. Final approval of stain color selections will be based on mockups.

a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each finish 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 finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior stains and finishes applied at project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
2. Shellacs, Clear: VOC not more than 730 g/L.
3. Stains: VOC not more than 250 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.

D. Stain Colors: As selected by Architect from manufacturer's full range.

2.2 WOOD FILLERS

A. Wood Filler Paste: MPI #91.

2.3 STAINS

A. Stain, Semi-Transparent, for Interior Wood: MPI #90.

2.4 WATER-BASED VARNISHES

A. Varnish, Water Based, Clear, Semi-Gloss (Gloss Level 5): MPI #129.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

C. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish 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 hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.

2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Manual."

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Wood substrates, nontraffic surfaces, including wood trim and architectural woodwork.

1. Semitransparent Stain System:

a. Prime Coat: Stain, semi-transparent, matching topcoat.
b. Topcoat: Stain, semi-transparent, for interior wood, MPI #90.

END OF SECTION 099300

SECTION 099313 – EXTERIOR STAINING AND FINISHING

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies an applied stain and sealer for horizontal cast-in-place concrete surfaces.

B. Related Sections: Refer to the following specification sections for coordination:
1. Section 033000 - Cast-In-Place Concrete.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions.

B Mock-Up: Prepare a test area minimum 2 by 2 feet in size to verify suitability of the stain, sealer and final appearance.

1.3 QUALITY ASSURANCE

A. Manufacturer: Minimum 10 years experience producing concrete coatings.

B. Installer: Licensed installers, experienced and trained in the use of these products.

C. Suitability of Substrate: Do not apply to concrete surfaces which may have insufficient chemical reaction, including older or weather concrete, concrete subject to runoff or weathered concrete, or heavily sandblasted concrete.

C. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and applicable codes at the location of the project.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in unopened factory labeled packages. Protect from damage.

B. Store in a safe place, out of direct sunlight. Keep containers tightly sealed. Do not allow product to freeze. Use within manufacturer’s recommended shelf life, approximately 12 months.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Stain: Vivid Acid Stain by Concrete Coatings Inc., 1105 North 1600 West, Layton, UT 84041, 800-443-2871, www.concretecoatingsinc.com. The concrete stain shall have the following properties:
1. Type: Penetrating chemical stain which chemically reacts with concrete.
2. Stain Colors: Architect to select from manufacturer’s full range.
3. Coverage: 200-300 square feet of concrete surface per gallon.

B. Concrete Sealer: Sealer by Concrete Coatings Inc., 1105 North 1600 West, Layton, UT 84041, 800-443-2871, www.concretecoatingsinc.com.
   1. Type: CCI SuperSeal 2000, 650 voc.
   2. Type: CCI GemKote High Gloss Sealer, meets 100, 350 and 400 voc requirements.
   3. Coverage: As recommended by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspection: Prior to start of application, inspect existing conditions to ensure surfaces are suitable for installation including the following:
   1. Concrete has cured for a minimum of 28 days prior to application of stain.
   2. Surface is completely free of sealers, oils, dirt, paint, alkali, penetrating sealers and foreign materials that would prevent the stain from penetrating the concrete surface.
   3. Concrete has been swept clean.
   4. Test area has been approved.

3.2 APPLICATION

A. Concrete Stain: Strictly comply with manufacturer's installation recommendations including the following:
   1. Use experienced installers wearing protective clothing and breathing apparatus.
   2. Test surface for suitable reactivity.
   3. Protect adjacent areas from over-spray, runoff, spills and tracking prior to application.
   4. For areas requiring material from more than one container, mix together prior to application to avoid color variation.
   5. Apply at rate recommended by manufacturer.
   6. Clean, rinse and neutralize surface.

B. Concrete Sealer: Strictly comply with manufacturer's installation recommendations. Apply after stain has dried at rate recommended by manufacturer. Clean surface as recommended by manufacturer.

3.3 CLEANING AND PROTECTION

A. Protection: Do not cover, but protect floor area from paint and other contaminates that could inhibit the stain.

END OF SECTION 099313

SECTION 101416 - PLAQUES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes plaques.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plaques.

1. Include fabrication and installation details and attachments to other work.
2. Show plaque mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each plaque at full-size scale.

C. Samples: For each exposed product and for each color and texture specified.

D. Plaque Schedule: Use same designations specified or indicated on Drawings or in a plaque or sign schedule.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PLAQUES, GENERAL

2.2 PLAQUES

A. Cast Plaque: Plaque with background texture, border, full color, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Plaque Material: Cast aluminum.
2. Plaque Thickness: 0.25 inch.
3. Finishes:

    a. Integral Metal Finish: As selected by Architect from full range of industry finishes.

4. Background Texture: As selected by Architect from manufacturer's full range.
5. Integrally Cast Border Style: Square double line, polished.
6. Mounting: Concealed studs.

2.3 MATERIALS

A. Bronze Castings: Alloy UNS No. C86500 (No. 1 manganese bronze).

B. Bronze Plate: Alloy UNS No. C22000 (commercial bronze).

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

3. Plaque Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque, unless otherwise indicated.
    b. Through Fasteners: Exposed metal fasteners matching plaque finish, with type of head indicated, installed in predrilled holes.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

A. General: Provide manufacturer's standard plaques according to requirements indicated.

1. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
3. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
4. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into panel surface indicated to produce precisely formed copy, incised to uniform depth.

1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel in colors indicated. Graphic/artwork to be provided by Architect.

C. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted plaques to suit plaque construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match plaque-background color color unless otherwise indicated.
2. Stainless-Steel Brackets: Factory finish brackets to match plaque background finish unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.

1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.
3. Brackets: Remove loose debris from substrate surface and install bracket supports in position so that plaque is correctly located and aligned.
4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of plaque and of suitable quantity to support weight of plaque after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as plaque is applied and to prevent visibility of cured adhesive at plaque edges. Place plaque in position, and push to engage adhesive. Temporarily support plaque in position until adhesive fully sets.

C. Remove temporary protective coverings and strippable films as plaques are installed.

END OF SECTION 101416

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Illuminated, fabricated channel dimensional characters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dimensional letter signs.

   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
   4. Show locations of electrical service connections.
   5. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

E. Delegated-Design Submittal: For signs indicated in "Performance Requirements" Article.

   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. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design sign structure and anchorage of dimensional character sign type(s) to withstand design loads as indicated on Drawings.

B. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

C. 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.

2.2 DIMENSIONAL CHARACTERS

A. Fabricated Channel Characters: Metal face and side returns, formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability and for securing fasteners; and as follows.

1. Illuminated Characters: Backlighted character construction with fluorescent tube lighting including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.

a. Power: As indicated on electrical Drawings.

2. Character Material: Sheet or plate aluminum.
3. Character Height: As indicated.
4. Character Depth: As indicated.
5. Finishes:

a. Integral Aluminum Finish: Clear anodized.

6. Mounting: Manufacturer's standard for size and design of character.

a. Hold characters at manufacturer's recommended distance from wall surface.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.

2. For exterior exposure, furnish stainless-steel or hot-dip galvanized devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

4. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
    b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
    c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

B. Adhesive: As recommended by sign manufacturer.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Internally brace signs for stability and for securing fasteners.
5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color color unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 101419

SECTION 101423.13 - ROOM-IDENTIFICATION SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes room-identification signs that are directly attached to the building.

B. Related Requirements:

1. Section 101416 "Plaques" for one-piece, solid metal signs, with or without frames, that are used for high-end room-identification.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
   1. Laminated-Sheet Sign: Sandblasted polymer MP plastic face sheet with raised graphics laminated to backing sheet to produce composite sheet.
      a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
      b. Color(s): As selected by Architect from manufacturer's full range.
   2. Sign-Panel Perimeter: Finish edges smooth.
      a. Edge Condition: Square cut.
      b. Corner Condition in Elevation: Square.
   3. Mounting: Manufacturer's standard method for substrates indicated with adhesive.

B. Sign Schedule: Provide one (1) sign for each interior room or area identified on plans. Submit sign schedule for Architect’s approval. Coordinate mounting location for each sign with Architect.

2.3 SIGN MATERIALS

A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings.

2.4 ACCESSORIES

A. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
3. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Mounting Methods:
1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

END OF SECTION 101423.13

SECTION 102113.16 - PLASTIC-LAMINATE-CLAD TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes plastic-laminate-clad toilet compartments configured as toilet enclosures and urinal screens.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachment details.

C. Samples for each type of toilet compartment material indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 PLASTIC-LAMINATE-CLAD TOILET COMPARTMENTS

A. Toilet-Enclosure Style: Overhead braced Floor anchored.

B. Urinal-Screen Style: Wall hung.

C. Door, Panel, and Pilaster Construction: One-piece, plastic-laminate facing sheets pressure laminated to core material without splices or joints in facings or cores; with laminate applied to edges before faces to seal edges and prevent laminate from being pried loose. Seal exposed core material at cutouts to protect core from moisture.

1. Core Material: Particleboard.
2. Doors and Panels: Finished to not less than 1 inch thick.
3. Pilasters: Provide construction to comply with one of the following:

a. Finished to not less than 1-1/4 inches thick.
b. Finished to 1-1/4 inches thick and with manufacturer's standard steel-sheet core laminated to both sides of honeycomb of resin-impregnated kraft paper in lieu of particleboard core.
c. Finished to not less than 1 inch thick and with internal, nominal 0.120-inch-thick, steel-sheet reinforcement.

D. Pilaster Shoes: Formed from stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

E. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.

F. Plastic-Laminate Finish: One color and pattern in each room.

1. Color and Pattern: As indicated on Finish Schedule.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel anchors compatible with related materials.

2.4 MATERIALS

A. Particleboard: ANSI A208.1, Grade M-2.

B. Plastic Laminate: NEMA LD 3, general-purpose HGS grade, 0.048-inch nominal thickness.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

D. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide in-swinging doors for standard toilet compartments and 36-inch-wide out-swinging doors with a minimum 32-inch-wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.

2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached near top and bottom of panel.

a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.16

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Childcare accessories.
4. Underlavatory guards.
5. Custodial accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full size, for each exposed product and for each finish specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of two 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. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fire-protection cabinets for portable fire extinguishers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fire-protection cabinets.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.5 SEQUENCING

A. Apply decals on field-painted fire-protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

B. Cabinet Construction: Match fire rating of surrounding partition.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
2. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Steel sheet.

G. Door Style: Fully glazed, frameless, backless, acrylic panel.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

J. Accessories:
1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door.
2) Application Process: Decals.
3) Lettering Color: Red.
4) Orientation: Vertical.

K. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel or powder coat.
b. Color: As selected by Architect from full range of industry colors and color densities.
2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

B. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

D. Identification: Apply decals at locations indicated.

E. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
   1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type: UL-rated nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

   1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 107313 – TRANSLUCENT CUSTOM AWNINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Conditions of the Contract, including Supplementary Conditions and Division 1 - General Requirements, apply to the work of this Section.

1.2 WORK INCLUDED:

A. Design, manufacture and installation of Standing Seam Monolithic (Non-Cellular) Polycarbonate system. An assembly of extruded solid polycarbonate glazing panels incorporated into a complete aluminum framed system that has been tested and warranted by the manufacturer as a single source system. Cellular or multi-cell polycarbonate panel is not acceptable.

B. All anchors, brackets, and hardware attachments necessary to complete the specified structural assembly, weatherability and water-tightness performance requirements. All flashing up to but not penetrating adjoining work are also required as part of the system and shall be included.

C. Trained and factory authorized labor with supervision to complete the entire panel installation.

1.3 QUALITY ASSURANCE

A. Materials and Products shall be manufactured by a company continuously and regularly employed in the manufacture of canopies using polycarbonate (not glass) panel systems for a period of at least ten (10) years.

B. Erection shall be by a factory-approved installer which has been in the business of erecting similar material for at least five (5) consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

C. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system, and will ensure that it fully meets all requirements of this specification.

1.4 APPROVED MANUFACTURERS:

A. All manufacturers acceptable for use on this project under this section must be approved prior to bid. Manufacturers must submit evidence of compliance with all performance criteria specified herein. This evidence must include proof of conformance and test reports as specified below. Any exceptions taken from this specification must be noted on the approval request. If no exceptions are noted and approval is given, product performance will be as specified. Should non-compliance be subsequently discovered, the previously given approval will be invalidated and use of the product on the project will be disallowed. Requests for approval, with all appropriate submittal data and samples must be received no less than 10 days prior to bid date. A list of all approved manufacturers and products will be issued by addendum. No other

manufacturers will be acceptable. No verbal approval will be given. Listing manufacturers' names in this specification does not constitute approval of their products or relieve them of compliance with all the performance requirements contained herein.

1.5 SUBMITTALS:

A. Submit shop drawings and color samples.

B. The manufacturer shall submit written guarantee accompanied by substantiating data, stating that the products to be furnished are in accordance with or exceed these specifications.

C. The manufacturer shall submit certified test reports made by an independent organization for each type and class of panel system. Reports shall verify that the material will meet all performance requirements of this specification. Previously completed test reports will be acceptable if they are current and indicative of products used on this project. Test reports required are:
1. Self-ignition Temperature (ASTM 1929)
2. Smoke Density (ASTM D-2843)
3. Burning Extent (ASTM D-635)
4. Interior Flame Spread per (ASTM E-84)
5. Water Penetration per (AAMA 501.2)
6. Large Missile Test – Impact Resistance per TAS 201-94
7. Impact level D per ASTM 1886 & ASTM E1996.
8. Concentrated Load per ASTM E661
9. Concentrated Load per OSHA and California Code of Regulations for 600 Ft-Lbs

D. Submit Installer Certificate signed by installer, certifying compliance with project qualification requirements.

1.6 MAINTENANCE DATA:

A. The manufacturer shall provide recommended maintenance procedures, schedule of maintenance and materials required or recommended for maintenance.

1.7 WARRANTY:

A. Provide a single source Canopy system manufacturer warranty against defective materials and fabrication. Submit manufacturer's written warranty agreeing to repair Canopy system work, which fails in materials within one year years of the date of delivery.

B. Provide single source manufacturer 10 year glazing panel warranty. Third party warranty for glazing panels shall not be acceptable. Glazing warranty to include:
1. Change in light transmission of no more than 6% per ASTM D-1003.
2. No delamination of panel affecting appearance, performance or structural integrity of the panel or the system.

C. In addition, submit installer's written warranty agreeing to repair installation workmanship, defects and leaks within one year of the date of delivery.

PART 2 - PRODUCTS

2.1 STANDING SEAM MONOLITHIC POLYCARBONATE GLAZING SYSTEM:

A. Basis-of-Design Product: Briteway - U-LITE Standing Seam Monolithic (Non-Cellular) Polycarbonate system as manufactured by CPI Daylighting, A Kingspan Light + Air Company, Phone: (800) 759-6985, Fax (847) 816-0425; Website: www.cpidaylighting.com www.kingspanlightandair.com

B. Alternate Manufacturer: Series 3900 Sleekline Monolithic Translucent Canopy as manufactured by Duo-Gard Industries, Inc.; Phone: (734) 207-9700; 40442 Koppernick Rd, Canton, MI 48187; Website: www.duo-gard.com

2.2 PANEL PERFORMANCE

A. Appearance:
1. Panel assembly thickness shall be a minimum 0.15” (4mm) single panel with exposed interlocking Aluminum U battens.
2. Panel Width: Shall not exceed 2’ to ensure best performance for wind uplift, vibration, oil canning and visual appearance. Panels over 2’ wide will not be approved.

B. Panel Joint System:
1. Panel shall be extruded in one single formable length. Maximum panel width shall not exceed 2’. Transverse connections are not acceptable.
2. The panels should be manufactured with up stands that are integral to the unit.
3. The up stands shall be 90 degrees to the panel face (standing seam dry glazed concept). Welding or gluing of upstands or standing seam is not acceptable.
4. The aluminum U battens shall have a screw down clamping mechanism to ensure the designed uplift capability.
5. Free movement of the panels shall be allowed to occur without damage to the weather tightness of the completed system.

C. Flammability:
1. The panel shall be an approved light transmitting plastic with a CC1 fire rating classification per ASTM D-635.
2. Smoke density no greater than 75 per ASTM D2843.
3. Minimum self-ignition temperature of 1000°F per ASTM 1929.
4. The panel shall be self-extinguishing. Flame spread no greater than 25 per ASTM E-84

D. Impact Resistance – the panels shall meet the following test requirements:
1. TAS 201-94, impact resistance of 350 Ft-Lbs
2. Impact resistance per ASTM 1886 & ASTM E1996 level D
3. Concentrated load per ASTM E661 of 400 Ft-Lbs
4. Concentrated load per OSHA and California Code of Regulations for 600 Ft-Lb Load

E. Weatherability:
1. Panels shall consist of a polycarbonate resin with a permanent, co-extruded, ultra-violet protective layer. Post-applied coating or films of dissimilar materials are unacceptable.

2. Color Change: Per ASTM D2244, No more than 3.0 units Delta E after 60 months outdoor weathering in Arizona as determined by an average of at least two samples.

2.3 METAL FRAME STRUCTURE

A. Design criteria shall be per the loads indicated on the drawings.

B. The glazing framing is designed to be self-supporting between the support constructions. The deflection of the structural framing members in a direction normal to the plane of the glazing, when subjected to a uniform load deflection, shall not exceed L/60 for the unsupported span. The canopies will impose reactions to the support construction. All adjacent and support construction must support the transfer of all loads, both horizontal and vertical, exerted by the canopies. Design or structural engineering services for the supporting structure or other building components not included in the canopy scope are not included under this section.

C. Water Penetration testing of the Metal Frame Structure shall be conducted according to procedures in AAMA 501.2.

2.4 METAL MATERIALS

A. Extruded Aluminum shall be ANSI/ASTM B221; 6063-T6: 6063-T5 or 6005-T5.

B. Flashing:
1. 5005 H34 aluminum 0.04” minimum thickness.
2. Sheet metal flashings/closures/claddings are to be furnished shop formed to profile - when lengths exceed 10 ft. in nominal 10-ft lengths. Field trimming of the flashing and field forming the ends is necessary to suit as-built conditions. Sheet metal ends are to overlap at least 6-in. to 8-in., set in a full bed of sealant and riveted if required.

C. All Fasteners for aluminum framing to be stainless steel or cadmium plated steel, excluding the final fasteners to the building.

D. All exposed ALUMINUM FINISH shall be from CPI standard color range:
1. Clear Anodize with 1 year warranty.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Contractor to verify when structural support is ready to receive all work in this section and to convene a Pre-Installation Conference at least one week prior to commencing work of this Section. Attendance required of General Contractor, canopy installer and all parties directly affecting and effected by the work of this section.

B. All submitted opening sizes, dimensions and tolerances are to be field verified by general contractor unless otherwise stipulated.

C. Installer to examine area of installation to verify readiness of site conditions. Notify general contractor about any defects requiring correction. Do not work until conditions are satisfactory.

3.2 INSTALLATION

A. Install components in strict accordance with manufacturer's instructions and approved shop drawings. Use proper fasteners and hardware for material attachments as specified.

B. Use methods of attachment to structure allowing sufficient adjustment to accommodate tolerances.

C. Remove all protective coverings on panels immediately after installation.

3.3 CLEANING

A. Follow manufacturer's instructions when washing down exposed panel surfaces using a solution of mild detergent in warm water that is applied with soft, clean wiping cloths. Always test a small area before applying to the entire area.

B. Follow strict panel manufacturer guidelines when removing foreign substances from panel surfaces requiring mineral spirits or any solvents that are acceptable for use.

C. Installers shall leave panel system clean at completion of installation. Final cleaning is by others upon completion of project, following manufacturer's cleaning instructions.

END OF SECTION 107313

SECTION 107516 - GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes ground-set flagpoles made from aluminum.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Delegated-Design Submittal: For flagpoles.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design flagpole assemblies.

B. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.

1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location as indicated on drawings.

2.3 ALUMINUM FLAGPOLES

A. Aluminum Flagpoles: Cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.

B. Exposed Height: 30 feet.

C. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch-diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.

2.4 FITTINGS

A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.

1. 0.063-inch spun aluminum, finished to match flagpole.

B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

1. Halyard Flag Snaps: Stainless-steel swivel snap hooks. Furnish two per halyard.

2.5 MISCELLANEOUS MATERIALS

A. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

B. Sand: ASTM C 33/C 33M, fine aggregate.

C. Elastomeric Joint Sealant: [**Multicomponent nonsag urethane**] [**Single-component nonsag urethane**] [**Single-component neutral-curing silicone**] joint sealant complying with requirements in Section 079200 "Joint Sealants."

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.6 ALUMINUM FINISHES

A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.

D. Place concrete, as specified in Section 033000 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.

B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION 107516

SECTION 113100 - APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cooking appliances.
2. Refrigeration appliances.
3. Television displays.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

1.6 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 MICROWAVE OVENS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide the following:
1. Samsung 1.1 Cu. Ft. Countertop Microwave, 1000W, Model No. MG11H2020CT (stainless steel finish). Quantity: 3.

B. Alternate Manufacturers:
1. GE.
2. Sharp.

2.3 FREE-STANDING ELECTRIC RANGE

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide the following:
1. Samsung – 30” 5.9 cu. ft. convection free-standing electric range (stainless steel). Model No.: NE59M4320SS. Quantity: 1.

B. Alternate Manufacturers:
1. KitchenAid.
2. GE.

2.4 RECIRCULATING RANGE HOOD

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide the following:
1. Samsung – 30” range hood (stainless steel). Model No.: NK30N70000US. Quantity: 1.

B. Alternate Manufacturers:
1. KitchenAid.
2. GE.

2.5 UNDERCOUNTER ICEMAKERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide the following:
1. KitchenAid 50 lb. (35 lb. storage) Built-in Icemaker (stainless steel). Model No.: KUIX505ESS. Quantity: 2.

B. Alternate Manufacturers:
1. Whirlpool.
2. LG.

2.6 REFRIGERATOR/FREEZERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide the following:
1. Samsung – 22.5 cu. ft. counter-depth French door refrigerator with thru-the-door ice and water (stainless steel). Model No.: RF23HCEDBSR. Quantity: 2.

B. Alternate Manufacturers:
1. Whirlpool.
2. LG.

2.7 DISHWASHERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide the following:
   1. Samsung StormWash 24” Top Control Built-In Dishwasher 14 Cu. Ft. 48-dBa noise level rating Model NO. DW80K5050US (stainless steel finish). Quantity: 2.

B. Alternate Manufacturers:
   1. KitchenAid.
   2. LG.

2.8 TELEVISION DISPLAYS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide the following:
   1. Samsung 55” Class Q80A Series QLED, Smart WebOS, 4K UHD, Model No. QN55Q80AAFXZA (black finish). Provide 1 adjustable mounting bracket per unit. Quantity: 9 of each. See Low Voltage Drawings for locations.
   2. Samsung 65” Class Q80A Series QLED, Smart WebOS, 4K UHD, Model No. QN65Q80AAFXZA (black finish). Provide 1 adjustable mounting bracket per unit. Quantity: 4 of each. See Low Voltage Drawings for locations.
   3. Samsung 85” Class Q80A Series QLED, Smart WebOS, 4K UHD, Model No. QN85Q80AAFXZA (black finish). Provide 1 adjustable mounting bracket per unit. Quantity: 4 of each. See Low Voltage Drawings for locations.

B. Alternate Manufacturers:
   1. LG.
   2. Vizio.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

   1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
   2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After installation, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

END OF SECTION 113100

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Chain-Retainer Type: Clip, jamb mount.
2. Spring Lift-Assist Mechanisms: Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.

B. Crank-and-Gear Operating Mechanisms: Sealed gearbox drive system controlled by detachable crank handle.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

F. Shadebands:

1. Shadeband Material: Light-blocking fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material.
b. Color and Finish: As selected by Architect from manufacturer's full range.

G. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
3. Endcap Covers: To cover exposed endcaps.
4. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
5. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
6. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.

7. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
8. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Type: Fiberglass textile with PVC film bonded to both sides.
3. Orientation on Shadeband: Up the bolt.
4. Features: Washable.
5. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Skylight Shades: Provide battens and seams at uniform spacings along shadeband as required to ensure shadeband tracking and alignment through its full range of movement without distortion or sag of material.
3. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

D. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 123661.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops.
2. Quartz agglomerate backsplashes.
3. Quartz agglomerate end splashes.
4. Quartz agglomerate apron fronts.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.
1. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Configuration:

1. Front: Straight, slightly eased at top, slightly eased at top with separate apron, 6 inches high, recessed 1/4-inch behind front edge.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops: 1/2-inch- thick, quartz agglomerate with front edge built up with same material.

D. Backsplashes: 1/2-inch- thick, quartz agglomerate.

E. Joints: Fabricate countertops without joints.

F. Joints: Fabricate countertops in sections for joining in field.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.

B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive.

F. Install aprons to backing and countertops with adhesive.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

H. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.19

SECTION 142123.16 – MACHINE ROOM-LESS ELECTRIC TRACTION PASSENGER ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes machine-room-less electric traction passenger elevators.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include Product Data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
2. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples: For each type of exposed finish involving color selection.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway and pit layout and dimensions, as indicated on Drawings, and electrical service including standby power generator, as shown and specified, are adequate for elevator system being provided.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded.

1.5 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Warranty Period: one year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

B. Accessibility Requirements: Comply with requirements for accessible elevators in the United States Access Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

2.2 MANUFACTURERS

A. Basis of Design Manufacturer: Subject to compliance with requirements, provide Evolution 200 3500 SP 200 machine room-less traction elevator as manufactured by Thyssen Krupp.

B. Alternate Manufacturers:
1. Kone.
2. Otis.

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description:
1. Rated Load: 3500 lb.
2. Rated Speed: 200 fpm.
3. Operation System: TAC32T.
4. Auxiliary Operations:

a. Standby power operation.
b. Battery-powered automatic evacuation.
c. Automatic dispatching of loaded car.
d. Nuisance-call cancel.
e. Loaded-car bypass.
f. Automatic operation of lights and ventilation fans.

5. Security Features: Car-to-lobby feature.
6. Car Enclosures:

a. Inside Width: Not less than 92 inches from side wall to side wall.

b. Inside Depth: Not less than 64-1/2 inches from back wall to front wall (return panels).
c. Inside Height: Not less than 93 inches to underside of ceiling.
d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish.
e. Car Fixtures: Satin stainless steel, No. 4 finish.
f. Side and Rear Wall Panels: Satin stainless steel, No. 4 finish.
g. Reveals: Satin stainless steel, No. 4 finish.
h. Door Faces (Interior): Satin stainless steel, No. 4 finish.
i. Ceiling: Satin stainless steel, No. 4 finish.
j. Handrails: 1-1/2 inches round satin stainless steel, No. 4 finish, at sides and rear of car.
k. Floor: Manufacturer's standard carpet.
l. Floor prepared to receive carpet (specified in Section 096816 "Sheet Carpeting").
m. Floor prepared to receive resilient flooring (specified in Section 096516 "Resilient Sheet Flooring").

7. Hoistway Entrances:

a. Width: 42 inches.
b. Height: 84 inches.
c. Type: Single-speed side sliding.
d. Frames: Satin stainless steel, No. 4 finish.
e. Doors: Satin stainless steel, No. 4 finish.

8. Hall Fixtures: Satin stainless steel, No. 4 finish.
9. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
b. Provide hooks for protective pads in and one complete set(s) of full-height protective pads.

2.4 TRACTION SYSTEMS

A. Elevator Machines: Permanent magnet, variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.

1. Provide regenerative system.
2. Provide regenerative system that complies with the IgCC.
3. Limit total harmonic distortion of regenerated power to 5 percent per IEEE 519.
4. Provide means for absorbing regenerated power when elevator system is operating on standby power.
5. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.

B. Fluid for Hydraulic Buffers: Fire-resistant fluid.

C. Machine Beams: Provide steel framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Section 055000 "Metal Fabrications" for materials and fabrication.

D. Guides: polymer-coated, nonlubricated sliding guides. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.

B. Auxiliary Operations:

1. Single-Car Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby. Manual operation causes automatic operation to cease.
2. Single-Car Battery-Powered Automatic Evacuation: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it moves to the next floor above or below, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
3. Off-Peak Operation: During periods of low traffic, half of the elevators in a group shall be taken out of service and switched to sleep, low power mode.
4. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after five minutes and are re-energized before car doors open.
5. Emergency Hospital Service: Service is initiated by a keyswitch at designated floors. One elevator is removed from group operation and directed to the floor where service was initiated. On arriving at the floor, elevator opens its doors and parks. Car is placed in operation by selecting a floor and pressing door close button or by operating keyswitch to put car in independent service. After responding to floor selected or being removed from independent service, car is returned to group operation. If car is not placed in operation within a preset time after being called, it is returned to group operation.

C. Security features shall not affect emergency firefighters' service.

1. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car-control stations.

2.6 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

A. General: Provide enameled or powder-coated steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:
1. Stainless-Steel Wall Panels: Flush, formed-metal construction; fabricated from stainless-steel sheet.
2. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
3. Sight Guards: Provide sight guards on car doors.
4. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
5. Metal Ceiling: Flush panels, with incandescent downlights in the center of each panel. Align ceiling panel joints with joints between wall panels.
6. Light Fixture Efficiency: Not less than 35 lumens/W.
7. Ventilation Fan Efficiency: Not less than 3.0 cfm/W.

2.8 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.

B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.

1. Fire-Protection Rating: 1 hour with 30-minute temperature rise of 450 deg F.

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
1. Stainless-Steel Frames: Formed from stainless-steel sheet.
2. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches high, on both jambs of hoistway door frames.
3. Stainless-Steel Doors and Transoms: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
4. Sight Guards: Provide sight guards on doors matching door edges.
5. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
6. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

2.9 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide buttons and lighted elements illuminated with LEDs.

B. Car-Control Stations: Provide manufacturer's standard recessed or semi-recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.

1. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Section 283113 Intelligent Fire Alarm Detection System.

E. Car Position Indicator: Provide digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

F. Hall Push-Button Stations: Provide one hall push-button station at each landing.

G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

I. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed.

J. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

K. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.10 FINISH MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled.

C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304.

D. Stainless-Steel Bars: ASTM A276, Type 304.

E. Stainless-Steel Tubing: ASTM A554, Grade MT 304.

F. Aluminum Extrusions: ASTM B221, Alloy 6063.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

B. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

C. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.

D. Set sills flush with finished floor surface at landing. Fill space under sill solidly with non-shrink, nonmetallic grout.

E. Locate hall signal equipment for elevators as follows unless otherwise indicated:

1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance.
3. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

3.3 PROTECTION

A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
3. Engage elevator Installer to provide full maintenance service.
4. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity.

END OF SECTION 142123.16

SECTION 220001 – PLUMBING WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Subject to the requirements of the Conditions of the Contract and Division 01 Sections of the Specifications, this Section applies to the furnishing and installation of Plumbing Work shown on the Drawings.

B. The scope of, and standards for, the Plumbing Work required for this project are depicted and stipulated on the Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The materials and equipment required for the Plumbing Work are specified on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The labor and workmanship required to accomplish the Plumbing Work are inferred on the Drawings if not expressly stipulated.

END OF SECTION 220001

SECTION 230001 – HVAC WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Subject to the requirements of the Conditions of the Contract and Division 01 Sections of the Specifications, this Section applies to the furnishing and installation of (Heating, Ventilating, and Air Conditioning) HVAC Work shown on the Drawings.

B. The scope of, and standards for, the HVAC Work required for this Project are depicted and stipulated on the Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The materials and equipment required for the HVAC Work are specified on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The labor and workmanship required to accomplish the HVAC Work are inferred on the Drawings if not expressly stipulated.

END OF SECTION 230001

SECTION 260001 – ELECTRICAL WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Subject to the requirements of the Conditions of the Contract and Division 01 Sections of the Specifications, this Section applies to the furnishing and installation of Electrical Work shown on the Drawings.

B. The scope of, and standards for, the Electrical Work required for this project are depicted and stipulated on the Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The materials and equipment required for the Electrical Work are specified on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The labor and workmanship required to accomplish the Electrical Work are inferred on the Drawings if not expressly stipulated.

END OF SECTION 260001

SECTION 27 01 00 - TELECOMMUNICATIONS OUTLINE OF WORK

PART 1 – GENERAL

SCOPE OF WORK:

The work included in Division 27 Communications includes, but is not necessarily limited to the following items and systems:

1. New wall-mounted cabinet, wire management, patch panels, and associated cable support components in TR 120.

2. New overhead support system and j-hooks installed to provide support for the horizontal cabling system.

3. New Category 6 structured cabling system to provide connectivity from each outlet, access point, wall phone, security camera and other connection points to support the new horizontal cabling system.

4. Copper cables to be terminated and tested according to the specifications.

5. Other work as described throughout the Contract Documents.

END OF SECTION 27 01 00

SECTION 27 05 44 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal Systems.
3. Sleeve-seal Products.
4. Silicone Sealants.

B. Related Requirements:

1. Division 07 Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

D. Sleeves for Rectangular Openings:

1. Material: Galvanized-steel sheet.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).

b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

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

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Specified Technologies Inc. (STI) – EZ-Path
b. Harnett Regional Jetport Approved Equal.

2.3 SLEEVE-SEAL PRODUCTS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Nelson Firestopping Systems
b. 3M Firestopping Systems
c. Harnett Regional Jetport Approved Equal

2.4 SILICONE SEALANTS
A. 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 that are not fire rated.
2. Sealant shall have VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Silicone Foams: Multi-component, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED COMMUNICATION PENETRATIONS

A. Comply with NEMA and UL for cable tray and cable penetrations.

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 3/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. De-burr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position the pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position the waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 2705 44

SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Telecommunications service entrance pathways.
5. Grounding.

B. Related Sections:

1. Section 27 15 00 "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.
B. IDF: Intermediate Distribution Frame.
C. ITS: Information Transport System.
D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
E. LAN: Local area network.
F. NRTL: The term "nationally recognized testing laboratory" (NRTL) means an organization which is recognized by OSHA which tests for safety, and lists or labels or accepts, equipment or materials.
G. RCDD: Registered Communications Distribution Designer.
H. RMU: Rack Mount Unit
I. Solid-Bottom or Non-ventilated Cable Tray: A fabricated structure consisting of a bottom without ventilation openings within integral or separate longitudinal side rails.
J. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.
K. TR: Telecommunications Room – See IDF
L. MCR: Main Communications Room or Server Room

1.4 PERFORMANCE COMPLIANCE

Design, manufacture, test, and install telecommunications cabling networks per manufacture’s requirements and in accordance with NFPA-70 (National Electric Code), state codes, local codes,

requirements of authorities having jurisdiction, and particularly the following standards:

A. ANSI/TIA/EIA-568-B.1 -- Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements
B. ANSI/TIA/EIA-568-B.2 -- Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components
C. ANSI/J-STD-607-A-2002 Commercial Building Grounding and Bonding Requirements for Telecommunications
D. ANSI/TIA/EIA - 569 -A: Commercial Building Standard for Telecommunication Pathways and Spaces
E. ANSI/TIA/EIA - 606 -A: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
F. ANSI/TIA/EIA – 607-A: Commercial Building Grounding and Bonding Requirements for Telecommunications
G. ANSI/TIA/EIA - 758: Customer-Owned Outside Plant Telecommunications Cabling Standard
H. IEEE 802.3 (series): Local Area Network Ethernet Standard, including the IEEE 802.3z Gigabit Ethernet Standard
I. ISO/IEC IS 11801: Generic Cabling for Customer Premises
J. BICSI: BICSI Telecommunications Cabling Installation Manual
K. BICSI: BICSI Telecommunications Distribution Methods Manual (TDMM)
L. U.S. Department of Homeland Security, TSA Structured Cabling System Guidelines Dated – July 2012
M. Planning Guidelines and Design Standards for Checked Baggage Inspection Systems Version 4.2 – Dated May 2014

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct

supervision of a RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of a BICSI-Registered RCDD or Technician, who shall be present at all, times when work of this section is performed at project site.

3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

B. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

C. Grounding: Comply with ANSI-J-STD-607-A.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.8 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier/service provider.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier/service provider representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.

2. Record agreements reached in meetings and distribute them to other participants.

3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone/voice system and LAN/data equipment.

4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

C. Exact locations and mounting heights of outlets shall be coordinated with the architect and the construction manager (CM).

D. The contractor shall be responsible for surveying the building and locating all back boxes, conduits, stub-ups designated for the sequence of work with the construction manager.

E. The contractor shall be responsible for coordination with other trades and drawings. Furthermore, the contractor shall coordinate the sequence of work with the construction manager.

F. The telecommunications contractor must review the drawings of all other trades and obtain pertinent information that pertains to the telecom work and is shown or indicated on other trade drawings. No extras will be permitted due to the failure of contractor to comply with this requirement. After review of all documents if the contractor feels something is not in his scope of work, he must take exception during his bid submission and clearly indicate the scope for which he is taking exception.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Cable Support: NRTL labeled. Cable support brackets or hooks shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.

1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
2. Support brackets with cable tie slots for fastening cable ties to brackets.
3. Lacing bars, spools, J-hooks, and D-rings.
4. Straps and other devices.

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used. All conduit to be provided by other trades.

1. For Telecommunications' Work Area Outlets, outlet boxes shall be no smaller than 4 inches wide, 4 inches high, double gang standard electrical back box with double gang mud ring and 2 1/2 inch deep. Boxes and conduit stub ups to be provided by others.

2.2 BACKBOARDS

A. Backboards: Install plywood, fire-retardant treated and painted white. Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels. Wall linings should extend from the finished floor to the structural ceiling (e.g., the slab) and should: be fire-rated as required by the applicable AHJ codes and regulations; have at least three walls lined with A/C grade or better, void-free fire-retardant plywood, 2.4 m (8 ft) high with a minimum thickness of 19 mm (3/4 in). Plywood should be kiln-dried to maximum moisture content of 15 percent; have the plywood with the grade A surface exposed. The plywood should be securely fastened to wall-framing members to ensure that it can support attached equipment. Plywood should be void-free, fire-rated and treated on all sides with at least two coats of fire-resistant light-colored paint. Contractor shall install with seals facing out and cover at least one with removable tape prior to painting.

B. Flush hardware and supports should be used to mount plywood. The strength and placement of the hardware should be sufficient to handle the total anticipated load (e.g., static and dynamic) and mounting of cabling components as specified by structural drawings and manufacturers' specifications.

2.3 EQUIPMENT CABINETS

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. Chatsworth Products, Inc.
2. Panduit
3. Hoffman Industries, Inc.

B. Wall-Mount Cabinet: Modular-type, steel construction.
1. Standard 26 RU with extra mounting rails, sides and lockable doors.
2. Minimum 48”H x 19” W x 24” D
3. Color: Black
4. Similar or Equal to: Chatsworth – P/N: 11840-748

C. Cabinet Overhead Bracing:

1. Used to secure the cabinet to the suspended cable tray system to stabilize the cabinet
2. Provide and install all appurtenances necessary to secure the cabinet to the floor as well as to the overhead cable tray system:

2.4 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping." Comply with TIA/EIA-569-B; Annex A, "Firestopping."
B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.2 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
B. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.
C. Telecommunications Main Bus Bar provided by others
D. Comply with ANSI-J-STD-607-A.
E. Furnish and install a minimum of a number 6-AWG stranded grounding conductor and grounding lugs for each individual equipment rack/cabinet and cable tray to the Telecommunications Grounding Bus Bar (TGBB) in each Telecom Room. Jumper each cable tray section to the next section. The grounding of the patch panels shall be done according to ANSI-J-STD-607-A.
F. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor. Remove paint as required to insure bond.

3.3 ENTRANCE FACILITIES

A. Coordinate with owner and telecommunications service provider for their installation of demarcation point, protected entrance terminals, and housing.

3.4 INSTALLATION

A. Comply with BICSI TDMM and drawings for layout and installation of communications equipment rooms.
B. Cable Support: Comply with TIA/EIA-569-A-7.
C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bend radii. Install lacing bars and distribution spools.
D. Conduits, sleeves, pull-boxes, and other wire-ways designated for communications cabling with the exception of innerduct are to be installed by others, except for the overhead cable pathways that are required in addition to the cable hooks. The Subcontractor is responsible for surveying the work area and coordinating with other trade drawings to locate all such wire-ways.
E. Provide and install the termination hardware for a complete cable plant, as shown on the detail drawings and described in this specification.
F. All termination hardware shall be mounted in the cabinet, as shown on the drawings. Bolt the cabinet to the floor slab, support from cable ladder tray, and ground to the building structure.
G. Horizontal cable within the Telecom Room shall be tie wrapped in bundles of 24 cables using black Velcro ties
H. Comply with requirements Comply with TIA/EIA-569-A; Annex A, "Firestopping."
I. Comply with ANSI-J-STD-607-A.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems." Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration including optional identification requirements of this standard.
C. Labels shall be preprinted or computer-printed type.

END OF SECTION 27 11 00

SECTION 27 1500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Pathways.
   2. UTP cabling.
   3. Multiuser telecommunications outlet assemblies.
   4. Cable connecting hardware, patch panels, and cross-connects.
   5. Telecommunications outlet/connectors.
   6. Cabling system identification products.
   7. Cable management system.
   8.

B. Related Sections:
   1. Section 27 1100 "Communications Equipment Room Fittings" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. UTP: Unshielded twisted pair.
B. BICSI: Building Industry Consulting Service International.
C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
D. EMI: Electromagnetic interference.
E. IDC: Insulation displacement connector.
F. TR/IDF: Telecommunications Room/Intermediate Distribution Frame room. Used interchangeably.
G. ITS: Information Transport System.
H. Ladder Rack: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
I. LAN: Local area network.
J. NRTL: The term "nationally recognized testing laboratory" (NRTL) means an organization which is recognized by OSHA which tests for safety, and lists or labels or accepts, equipment or materials
K. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
L. RCDD: Registered Communications Distribution Designer.

1.4 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

B.
   1. Harnett Regional Jetport specifications require two (2) Category 6 cables at each standard

outlet location. A typical outlet configuration, unless otherwise specified, is defined as consisting of two (2) Category 6 cables (blue) in a four (4) port faceplate with two (2) Category 6 jacks, one (1) for voice and one (1) for data and two blanks. Colors are as detailed within the drawings.

2. Each of the cables in the faceplate will be separated – (Voice and Data) and shall terminate on a separate patch panel in each cabinet in the Telecom Room.
3. Bridged taps and splices shall not be installed in the horizontal cabling.
4. Leave 1 foot of slack coiled above the workstation location.

C. Cabling destinations are identified within the drawings. The contractor will pay close attention to the cables running to different telecom rooms.

D. All wireless access points, wall phones and surveillance cameras shall require one (1) blue Category 6 cable at each location. A single cable outlet configuration, unless otherwise specified, is defined as consisting of one (1) Category 6 cable (blue) in a two (2) port faceplate with one blue Category 6 jack and one blank.

E. The Installer shall provide at the main fire alarm panel two Category 6 (YELLOW) cables terminated in a surface mount box and terminated on a separate BAS SERVICES patch panel located in the Telecom Room 120.

F. The Installer shall provide at the main security intrusion alarm panel two Category 6 (YELLOW) cables terminated in a surface mount box and terminated at the demarc panel.

G. All security cabling, access control, surveillance cameras, security cabling to security monitoring stations shall be installed in a security cabinet. All security network cabling shall comply with this section.

H. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

I. The maximum allowable horizontal cable length is 295 feet (90 m) for UTP cable. This maximum allowable length does not include an allowance for the patch cord length of 16 feet (4.9 m) to the workstation equipment. The maximum allowable length does not include an allowance for the patch cord length of 16 feet (4.9 m) in the horizontal cross-connect.

J. The installer shall provide where noted an HDMI cable to each of the displays identified as shown on the design drawings. All cable shall be factory-terminated with connectors rated and approved for the type of cable. Provide HDMI inserts for the faceplates.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

A. Product Data: For each type of product specified, provide a manufacturer product data cut sheet.

B. Instruction Manuals: The contractor shall compile and provide three (3) copies of complete manuals on the finished system to include: operating and maintenance instructions, manufacturer's catalog pages of all equipment and components, as-built wiring and conduit diagrams (both floor plan and riser types).

C. Training: In addition to the above manuals, the contractor shall provide the services of a trained manufacturer's representative for a period of four (4) hours, during normal business hours, to instruct designated personnel on the operation and maintenance of the entire system.

D. Maintenance Contract: The equipment vendor shall furnish a one (1) year maintenance contract, free of charge to the owner, effective from the date of final acceptance of the system. There shall be a minimum of two (2) inspections during the contract year. On the premises, maintenance is to be performed during normal business hours, at no cost to OWNER, for a period of twelve (12) months

from the date of final acceptance of the system, unless damage is caused by misuse, abuse or accident.

E. Shop Drawings:
   1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
   2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
   3. Cabling administration drawings and printouts.
   4. Wiring diagrams to show typical wiring schematics, including the following:
   5.
      a. Cross-connects.
      b. Patch panels.
      c. Patch cords.

   6. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

F. Samples: For workstation outlets, jacks, faceplates, jack assemblies, in specified finish, one for each size and outlet configuration.

G. Qualification Data: For Installer qualified layout technician, installation supervisor, and field inspector.

H. Maintenance Data: For splices and connectors to include in maintenance manuals.

I. Warranty:
   1. The Contractor shall warranty the Communications Cable Plant, in writing, against defects in workmanship and material for a period of one (1) year after acceptance by the Owner. During this time, the entire Communications Cable Plant shall be kept in proper operating condition at no additional labor or material cost to the Owner. Communications Cable Plant consists of all cabling and termination hardware specified herein.
   2. The Contractor shall provide, in addition, a twenty-five (25) years performance warranty for a complete end-to-end system provided by the connectivity manufacturer which covers all labor and materials. The warranty must be applied to the horizontal subsystems. The horizontal subsystem includes the Category 6 copper cables, outlets, jacks, patch panels, connectors, and termination blocks. The Contractor shall include information on how this warranty applies to both material and labor as well as to Owner's ability for maintaining the system in compliance with extended warranty. All details of this warranty shall be coordinated with the manufacturer to ensure that all applies and any additions are extended to the owner.
   3. Acceptance is issued, in writing only, after the project is fully completed, tested and all close-out material submitted in accordance with Contract Documents and to the satisfaction of the Owner or its duly authorized representative.
   4. The Contractor shall assume responsibility for quality and satisfactory operation of components and materials not manufactured by Communications Contractor. All warranties provided by manufacturers shall be extended to the Owner and certified in writing

1.7 QUALITY ASSURANCE

A. Installer Qualifications: All work must be done by a qualified Installer authorized by the system manufacturer. Any defects or malfunctions in the system resulting from improper installation shall be corrected at no additional cost to the Owner. Cabling Installer must have personnel certified by BICSI on staff.

B.
   1. Layout Responsibility: Preparation of Shop Drawings and field testing program

development by an RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
4. Manufacturer Authorization: The installer shall provide with his submittal proof of registration and authorization to offer an extended 25-year performance warranty on the system proposed covering all labor and materials for the warranty period.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-B.
D. Grounding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
   1. Deliver factory box test reports for each box of 1000' of Category 6 cable.
B. Packaging and shipping
   1. Deliver materials and equipment in time for inspection, and tests in accordance with approved project schedule. Coordinate delivery schedule with the Construction Manager.
   2. All shipment arrangements for unloading at site shall be coordinated.
   3. Movement of material, either at the time of delivery or subsequently, shall be the sole responsibility of the Communications Contractor. All costs involved with the movement shall also be the responsibility of the Communications Contractor.
   4. Where necessary, ship equipment in containers or boxes of appropriate size to permit passing through available spaces.
C. Storage and protection
   1. Neatly pile and store loose materials at job site under watertight cover on wood blocking or in suitable areas away from damp surfaces as designated by the Construction Manager.
   2. Protect existing work that may be damaged during subsequent construction and other normal activities.
D. Clean Up and Storage
   1. The contractor shall abide by all terms and conditions of the Construction Manager regarding the removal of trash and work area clean-up.
   2. Prior to acceptance of work, all areas used or entered by the Contractor must be cleared of any materials or debris caused directly or indirectly by the Contractor to the satisfaction of the Owner or its duly authorized representative.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
B. Survey: The Contractor shall be responsible to survey all areas to locate poke-troughs, furniture openings, sleeves, conduits, cable trays, conduit stub-ups, back boxes, and pull boxes provided by others for the communication cabling. Additionally, the Contractor shall be responsible to survey areas where ladder racks, cable trays, cable ties, and cable hangers are to be installed and secured.
C. Labor Harmony: The Contractor shall be responsible for meeting project schedule dates regardless of local disputes. The Contractor shall be responsible for protection of his work from acts of vandalism. The Contractor shall be responsible for the protection of all installed and configured systems as well as non-installed stored materials from acts of theft.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.
B. Coordinate layout and installation of telecommunications pathways and cabling with other trades.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-B.
B. Cable Support Hooks: NRTL labeled for support of Category 6 designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
2. Support brackets with cable tie slots for fastening cable ties to brackets.
3. Lacing bars, spools, J-hooks, and D-rings.
4. Straps and other devices.

2.2 BACKBOARDS

A. Backboards: Install plywood, fire-retardant treated and painted with white fire retardant paint. Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels. Wall linings should extend from the finished floor to the structural ceiling (e.g., the slab) and should: be fire-rated as required by the applicable AHJ codes and regulations; have at least three walls lined with A/C grade or better, void-free plywood, 2.4 m (8 ft) high with a minimum thickness of 19 mm (3/4 in). Plywood should be kiln-dried to maximum moisture content of 15 percent; have the plywood with the grade A surface exposed. The plywood should be securely fastened to wall-framing members to ensure that it can support attached equipment. Plywood should be void-free and fire-rated or treated on all sides with at least two coats of fire-resistant light-colored paint. Flush hardware and supports should be used to mount plywood. The strength and placement of the hardware should be sufficient to handle the total anticipated load (e.g., static and dynamic) and mounting of cabling components as specified by structural drawings and manufacturers' specifications.

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, are as follows:
1. Panduit
2. CommScope, Inc.
3. Leviton Network Solutions
4. Approved equal

B. Description: mid-grade, Plenum rated Category 6 (Category 6) 100-ohm; 4-pair UTP specified 400 MHz or more; covered with a blue thermoplastic jacket. Each 4-pair 100-ohm balanced twisted-pair Category 6 cable must be terminated in an eight-position connector at the communications work area outlets.
1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.

3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
   a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, are as follows:
   1. Panduit
   2. CommScope
   3. Leviton Network Solutions
   4. Approved equal

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher (Category 6).

C. Patch Panel: Modular panels housing multiple-numbered Category 6 jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

D. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

E. Patch Cords: Factory-made, 4-pair Category 6 cables in Factory-made, 4-pair cables in 5’ & 7’ lengths; terminated with 8-position modular plug at each end.

   1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
   2. Patch cords shall have color-coded boots for circuit identification
   3. Provide two for each outlet; regardless of type.
   4. Patch cables shall be manufactured by the same company as the cabling system.

2.5 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.

B. Workstation Outlets: four-port connector assemblies mounted in single faceplate.

   1. Faceplate: Complying with requirements in Division 26 Section "Wiring Devices." NOTE: Coordinate with Division 26 and use the same style, materials and color faceplates to match the electrical plates.
   2. For use with snap-in jacks, either 4-pair modular or CATV F-style pass-through connector, and accommodating any combination of UTP, optical fiber, and coaxial work area cords.
   3. Legend: Machine printed, in the field, using adhesive-tape label.
   4. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.6 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical

building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

2.7 IDENTIFICATION PRODUCTS

A. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

B. See Section 271500 "Communications Horizontal Cabling" for additional identification requirements. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration including optional identification requirements of this standard.

C. Comply with requirements in Section 271500 "Communications Horizontal Cabling" for cable and asset management software.

D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

F. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

2.8 SOURCE QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP jacket materials markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    b. Category 6 Performance
        1) A level III test unit is required to verify Category 6 performance and must be updated to include the requirements of ANSI/TIA/EIA-568-B.1.
        2) The primary field-tests parameters leading to Pass/Fail criteria used to verify installed horizontal cabling is listed below. These parameters are defined in ANSI/EIA/TIA-568-B.1.
        3)

a) Wire Map
b) Length
c) Insertion Loss
d) Near-end cross talk (NEXT) loss
e) Power sum near-end cross talk (PSNEXT) loss
f) Equal-lever-far-end cross talk (ELFEXT)
g) Power sum equal-lever-far-end cross talk (PSELFEXT) loss
h) Return Loss
i) Propagation Delay
j) Delay Skew

4) Test unit manufacturer: Fluke DTX CableAnalyzer™ preferred.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
B.
1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems".
3.
C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
D. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bend radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF PATHWAYS

A. Cable Conduits: Provided by others. Comply with TIA/EIA-569-B.
B. Coordinate cable connection hardware installations and specialty arrangements with layout drawings and requirements specified for communications equipment rooms
C. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
D. Comply with TIA/EIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.
E. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

F. Pathway Installation in Communications Equipment Rooms:

G.

1. Install ladder rack to route cables.
2. Secure conduits sleeves to backboard when entering room from overhead.
3. Extend conduits 3 inches (76 mm) above finished floor.

H. Backboards: Install plywood, fire-retardant treated and painted with white fire retardant paint. Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels. Wall linings should extend from the finished floor to the structural ceiling (e.g., the slab) and should: be fire-rated as required by the applicable AHJ codes and regulations; have at least three walls lined with A/C grade or better, void-free plywood, 2.4 m (8 ft) high with a minimum thickness of 19 mm (3/4 in). Plywood should be kiln-dried to maximum moisture content of 15 percent; have the plywood with the grade A surface exposed. The plywood should be securely fastened to wall-framing members to ensure that it can support attached equipment. Plywood should be void-free and fire-rated or treated on all sides with at least two coats of fire-resistant light-colored paint. Flush hardware and supports should be used to mount plywood. The strength and placement of the hardware should be sufficient to handle the total anticipated load (e.g., static and dynamic) and mounting of cabling components as specified by structural drawings and manufacturers' specifications.

I. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.3 INSTALLATION OF CABLES

A. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6 and "Cable Termination Practices".
3. Install IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

B. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches (200mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

C. Group connecting hardware for cables into separate logical fields.
D. Separation from EMI Sources

1. Comply with BICSI TDMM and TIA/EIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
3.
    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
    d.
4. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
5.
    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
    d.
6. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
7.
    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
    d.
8. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
9. Separation between Communication Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

A. Comply with TIA/EIA-569-B; Annex A, "Firestopping."
B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 3.5 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
B. Comply with ANSI-J-STD-607-A.
C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

    1. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
C. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
D. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.
E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
G. Cable and Wire Identification

    1. Label each cable within 4 inches (100 mm) of each termination, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
    2. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    3. Identification within Connector Fields in Equipment Rooms and Wiring Closets
    4.
        a. Label each connector/cable behind each patch panel and each discrete unit of cable-terminating and connecting hardware.

H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts

with cable jacket color but still complies with requirements in TIA/EIA-606-A.

I.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. Tests and Inspections

1. Visually inspect UTP and optical fiber jacket materials markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
   a. Visually confirm Category 6 marking of outlets, cover plates, outlet/connectors, and patch panels.

3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
4.
   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Category 6 Performance

      1) A level III test unit is required to verify Category 6 performance and must be updated to include the requirements of ANSI/TIA/EIA-568-B.1.
      2) The primary field-tests parameters leading to Pass/Fail criteria used to verify installed horizontal cabling is listed below. These parameters are defined in ANSI/EIA/TIA-568-B.1.
      3)
         a) Wire Map
         b) Length
         c) Insertion Loss
         d) Near-end cross talk (NEXT) loss
         e) Power sum near-end cross talk (PSNEXT) loss
         f) Equal-lever-far-end cross talk (ELFEXT)
         g) Power sum equal-lever-far-end cross talk (PSELFEXT) loss
         h) Return Loss
         i) Propagation Delay
         j) Delay Skew

   c. Test unit manufacturer: Fluke DTX CableAnalyzer™ preferred. Other test units are acceptable.

5. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.

C. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
D. End-to-end cabling will be considered defective if it does not pass tests and inspections.
E. Prepare test and inspection reports.

3.8 DEMONSTRATION

A. A. Engage a factory-authorized service representative to train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION 27 1500

SECTION 27 40 00 - AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Contractor shall review all other documents for additional requirements and information that apply to the Work. If conflicts between this Section and/or the General Requirements and General Conditions occur, the more stringent shall apply. Contractor shall deliver the complete Audio-visual System, including any design-build requirements of this Section and drawings.

B. Create a final A/V system design using the major components shown within the design drawings. Products shown are the basis of design and meet the owner's minimum performance specifications. This is intended to be a complete turnkey system with all cabling, installation, programming and training.

C. The architectural, electrical, telecommunications and AV drawings show the AV infrastructure installed by General Contractor/Electrical Contractor/Telecom Contractor and should be used for reference. Drawings will be available per request from the General Contractor.

1.2 DESCRIPTION

a. The following is a summary of the audio-visual system requirements.

1.3 SCOPE OF WORK

A. Contractor shall provide a turn-key audio-visual system installation including, but not limited to, all cabling, displays, control systems, presentation systems, loudspeakers, displays, mounting hardware and electrical components including the necessary equipment, interconnections, transducers, labor, and services required to meet the functional requirement outlined in the design documents.

B. The Contractor will provide full submittals and shop drawings as noted elsewhere in this section. The contractor will confirm system designs and documents meet field conditions. This review should include, but is not limited to, display calculations, audience site lines, loudspeaker coverage, display sizes, etc. Notify Owner immediately of any discrepancies that may exist between the Contract Documents and existing conditions. Changes to the system design required to address these issues, due to a failure to review field conditions in a timely manner, may require corrective action by the contractor at no cost to the owner, architect, or design consultant.

C. The Contractor will be held responsible to have examined the site and premises and satisfied them self as to existing conditions under which they will be obligated to operate in performing their part of the work or that, which will in any manner affect the work under this contract.

D. Permits: Obtain any necessary permits for the execution of this work in conformance with applicable union regulations, local, State and Federal codes and regulations.

E. All aesthetic issues are to be coordinated and approved by the Owner, Architect and Design Consultant.

F. Verify all conduit and penetrations, wire raceways, back boxes, mounting hardware to building structure and cabling connecting system components, as required by the Audio-visual System and installed by the General Contractor/Electrical Contractor as part of the base building fit out. Notify Owner of any discrepancies that may exist between the Contract Documents and existing conditions.

G. Verify 120-volt AC power requirements for each equipment location. Notify Owner of any discrepancies that may exist between Contract Documents and existing conditions.

H. Patch, repair, finish and paint any surfaces that are damaged or demolished for access during this work. Room finishes to be returned to initial condition.

I. Coordinate the installation of the audio-visual system issues including, but not limited to, architectural and structural items associated with the project.

J. Coordinate with other trades to ensure that all required access and clearances to equipment and services are provided and maintained.

K. Verify site conditions including dimensions and clearances. Coordinate and size the exact location of the equipment racks with the architectural drawings.

L. Conduct preliminary testing and adjustment. Submit documentation required by this Specification. Participate in approval testing for acceptance by the Owner. Perform final adjustments as required to meet the Specifications.

M. Deliver to the Owner, bound "as-built" system documentation. Transfer all warranties and equipment guarantees to the Owner and provide a written description of system operation at the time of acceptance of the Work by the Architect/Owner.

N. Provide system operation training as specified in Part 3 of this Section.

1.4 QUALITY ASSURANCE

A. All materials must be newly manufactured current production models and conform to all applicable codes and the relevant standards listed below:

1. American National Standards Institute (ANSI)
2. Electronic Industries Alliance (EIA)
3. Institute of Electrical and Electronic Engineers(IEEE)

B. Experience: The Contractor shall specialize in the installation of audio-visual systems, have a minimum of five years of documented experience in the field of audio-visual system installation and be a manufacturer-approved vendor for all of the components installed.

C. Supervision: Contractor shall designate a Project Manager and Foreman to oversee the installation work for the duration of the Work, to ensure that the system is installed in accordance with the Specification and Drawings.

D. Project Manager shall maintain adequate staff and be responsible for installing and testing the system on schedule.

E. Project Manager and Foreman/Project Supervisor shall have at least five years of documented, recent and similar project experience.

F. The Owner reserves the right to make use of the system prior to the completion of the Work. Temporary use of the equipment shall not constitute an acceptance of the system or any part. The Owner shall not pay additional cost to the Contractor and the commencement of the warranty period shall not begin for the system or any device prior to the completion of the punch list and final acceptance of the system, by the Owner.

G. Contractor shall promptly notify the Owner, in writing, of any difficulties that may prevent proper coordination or time of completion of the Work. Failure to do so shall constitute acceptance of work and indicate that the site is suitable in all ways for this Work, except for defects that may develop in the work of others after commencement of system installation.

H. Insurance: Provide evidence of insurance for the full value of equipment and material located on-site. Insurance shall cover losses due to fire, theft and vandalism, until the final acceptance of the system, by the Owner. Maintain additional liability insurance to protect the supplier and/or Owner, Architect, Design Consultant against damage claims for personal injury, including death, which may arise during the performance of this work.

1.5 REFERENCES

A. All requirements of the latest published edition, unless otherwise noted, shall apply:

1. National Electric Code (N.E.C.)
2. National Electric Safety Code (N.E.S.C.)
3. American National Standards Institute (A.N.S.I.)
4. Electronics Industries Alliance (E.I.A.)
5. Society of Motion Picture and Television Engineers (S.M.P.T.E.)
6. American Society for Testing Materials (A.S.T.M.)

1.6 SUBMITTALS

A. Contractor shall comply with the General Requirements and General Conditions of this Specification.

B. Bid Submittals: Contractor shall submit the following qualification documents with the bid proposal:

1. Firm description of the Contractor, and a copy of the Contractor’s license, as well as a statement regarding the relationship of the License Holder to the Contractor.

2. Provide a minimum of three related projects, four of which must have been completed within the last 12 months and local to project location.
3. Résumé of Project Manager and Foreman/Project Supervisor documenting related experience. Foreman/Project Supervisor must have completed at least two similar installations in the past 12 months.
4. Submit a list of major equipment components, along with any deviations, to the system design and Specification. Indicate which products will not be purchased directly from the manufacturer.
5. Submit a list including names, firm description, job foreman, copy of license and scope of work, for any subcontractors whose work would be part of this Contract.
6. Submit a list of names for the lead installers who will be working on this project and indicate for each, if they are:
   a) NSCA NICET/EST or ICIA CTS-Install, certified or registered.

C. Construction Submittals

1. Provide shop drawings and record drawings using the following scales:
   a) Plans -not less than 1/8” = 1’-0”
   b) Details -not less than 1/4” = 1’-0”

2. Before ordering equipment, submit catalog data sheets, neatly bound with title page, space for submittal stamps and tabbed dividers between sections. List all proposed equipment with reference to corresponding specification paragraph numbers or equipment title. Denote all approved substitutions.
3. Submit point-to-point wiring diagrams and typed wire lists identifying every connection. Include electronic devices such as switches, transformers and terminal blocks. Indicate location of all components. Identify cables by types, colors and wire numbers.
4. Submit system plans showing all device locations.
5. Submit reflected ceiling plans showing distributed loudspeaker layouts with wattage tap settings, projection systems, cameras and other ceiling mounted devices.
6. Submit conduit diagrams showing connection of all devices along with types and quantities of cables to be used and cable identification tags.
7. Submit rack layouts indicating the proposed arrangement of mounted equipment including junction boxes and locations of conduit penetrations.
8. Submit fully dimensioned construction details of all panels, plates and other custom fabricated items or modifications (e.g. installation of audio/visual equipment in lecterns). Include complete parts lists and, as required, schematic diagrams.
9. Submit fully dimensioned construction details of all coordination items, such as panel or plate installation in casework or millwork.
10. Submit a schedule of finishes indicating proposed materials and color selections for all exposed items subject to Architect’s approval.
11. Submit samples of engraved labels, cable-marking system, faceplate etching/finishes and loudspeaker grilles.
12. Submit mounting and support details for distributed ceiling loudspeakers, video projectors and all other items mounted overhead, complete with parts lists and dimensions. Include a full plan view, front elevation and side elevation of each item, with corresponding support structure and mounting hardware. Verify load ratings of all hanging components including attachment hardware.

13. Submit a list showing coordination of selected frequencies for all wireless transmitters.
14. Before final control system program installation, submit printed copies of all control system touch panel pages as well as an electronic copy of the pages as required by Part 2 of this Section.
15. Acceptance Test Submittals: Prior to requesting the completion of the acceptance tests, submit Preliminary Test Report Information required in Part 3 of this Section.

1.7 PROJECT CLOSE OUT

A. GENERAL

1. Furnish one initial set of Project Close Out Documents including but not limited to manuals, record drawings along with the results of all source quality control tests, and field quality control tests specified in Part 3 of this Section, to the Design Consultant, for use during acceptance testing.
2. If 'as installed' documents are rejected, correct and resubmit in the manner specified.
3. One set of "B" size drawings showing the components and wiring in each individual rack shall be mounted in a plastic jacket to the rear door of the associated rack.
4. After approval of 'as installed' documents, submit four sets of record drawings each consisting of the following:
   a) One set of full size prints
   b) One set of reduced B size prints
   c) One set of manuals
   d) One electronic submittal on CD-ROM disk(s).
   e) Furnish one initial set of product brochures to the Design Consultant for use during acceptance testing and equalization. At the time of contract closeout, submit four sets of the system Operation Manual and the Maintenance Data Manual.

B. AS INSTALLED DRAWINGS

1. Maintain a full set of shop / submittal drawings at the project site, marked up to indicate actual locations, wattage tap settings and, in general, the true state of the installation.

C. MANUALS

1. Neatly bind each manual with tabbed dividers between sections, include a title pages between sections, binder title covers and spines.
2. Manuals shall be presented in 3 inch thick, 3-ring – D style binders.
3. The Manuals shall be broken down into the following minimum sections:
   a) Operations Manual
   b) Table of Contents

4. Typed description of each system including key features and operational concepts (e.g. remote control features, switching or routing functions, patch points, mixing and linking capabilities).

5. Setup diagrams and typed instructions for use in typical situations as directed by the Design Consultant.
6. Small scale plans showing locations and circuit numbers for all system outlets and receptacles.
7. Single-line block diagrams showing all major system components.
8. One set of B size drawings showing the components and wiring in each individual rack.
9. Manufacturer's operation manuals for equipment intended for operation by system users
    a) Maintenance Data Manual
    b) Table of Contents
    c) Company name, address, telephone number and contact name for system service or maintenance.
    d) Listing of all equipment and materials with names of manufacturers and model numbers or part numbers.
    e) Catalog data sheets displaying manufacturer's names, addresses and telephone numbers.
    f) Product manufacturer's warranties and a typed, one-year system warranty, explicitly covering all materials and labor.
    g) Manufacturer's service manuals for all major equipment items.

10. Test documentation showing results of source quality control tests, field quality control tests, acceptance testing and equalization. Document final settings for all non-user devices and controls after completion of acceptance testing and equalization and include raw and equalized house curves. Document the physical position of settings as well as input and output signal levels as required by Part 3 of this Section.
11. Provide a recommended preventative maintenance schedule for reference to the applicable pages in the manufacturer's maintenance manuals. Where the manufacturer provides inadequate information, develop and provide the information necessary for proper maintenance.

D. SOFTWARE

1. A properly licensed working copy of any and all software required to operate or configure the systems specified herein, shall be a part of the system supplied, including all software, firmware and hardware required for configuration, adjustment, diagnosis and repair.
2. All software shall be fully documented, and that documentation included.
3. Software shall be included in its 'installable' state on industry standard, CD-ROM, or other appropriate format from the manufacturer. Where possible a single master CD-ROM should be provided. If files are too large, break segments into logical sections, CD-ROM disk images are unacceptable.
4. Where any elements of the software are based on, user modifiable source code, both the source code and the compiler shall be provided and documented as stated herein.
    a) The source code is to be licensed to the Owner for this project; the contactor maintains the copyright of the source code.
    b) The Owner has the right to modify the source code.
    c) If the source code is modified the Owner takes full responsibly for the effects caused by the modification to the source code.

E. ELECTRONIC SUBMITTAL

1. In addition to the above listed hard copy submittals, submit all files necessary to produce the above submittals as follows:
   a) Submit the following on CD-ROM media or USB Media:
      1) Files use long windows names file structure.
      2) A Disk Master File List in text format shall be placed on the CD-ROM or USB drive with a short description of files on that disk.

2. Drawings shall be in AutoCAD r2020 or later drawing (.DWG) format. Drawing Exchange File Format (.DXF) shall not be acceptable. All XREFs, fonts, and other drawing parts necessary to the drawings shall be included.
3. Documents and spreadsheets shall be in Microsoft Office 365 format.
4. All files to be converted to searchable acrobat *.PDF files in addition to the native drawing, documents and spreadsheets formats.
5. Two (2) Manufacturers' service manuals provided by the Manufacturer to the Contractor or documents that are similarly, not otherwise available to the Contractor in electronic format shall be excluded from this requirement.
6. Provide all control system source files and compilers on the same CD-ROM media or USB media. This should include, but is not limited to, touch panel files, IR code files, DSP configuration files, web-based touch panel pages, or any other files or applications necessary to completely reinstall and configure all system components back to their operable state.
7. Keys: Submit three sets of all keys required for access to and operation of the systems.

1.8 GUARANTEES AND WARRANTIES

A. Transfer all manufacturer and subcontractor's warranties to the Owner at the completion of all Work.

B. Guarantee all installation work to be free of faulty system-wide workmanship. Guarantee all new components purchased under this Contract and workmanship to be free from defects for a period of 12 months from the final date of acceptance, by the Owner, including solid-state devices.

C. Guarantee the replacement of faulty materials and workmanship within 24 hours of notification at no cost to the Owner if failure occurs during warranty period. Provide loaner equipment as required to keep the system operational if the system cannot be repaired within 24 hours of notification.

D. Register warranty in the Owner's name for any product with a manufacturer's warranty of more than one year.

1.9 MAINTENANCE

A. With the bid, submit an annually renewable service and maintenance proposal meeting the same conditions for service and repair as required for the initial one-year warranty. If accepted, the service and maintenance proposal shall commence upon conclusion of the one-year system warranty.

PART 2 - PRODUCTS

2.1 GENERAL

A. Components are to operate on a 110 to 120 volt, 60 Hz electrical supply. Rack mounted equipment is to be mounted in a standard EIA 19-inch wide rack in either credenza or in podium locations. The components listed in the drawing set are the basis of the audio-visual system design and represent the minimum standards for each of the components. All of the properties of each component or system should be considered listed in full.

B. Equipment, excepting the owner-furnished equipment and materials shall be new. The latest version at time of delivery and shall conform to applicable UL, CSA, or ANSI provisions. Take care during installation to prevent scratches, dents, chips, etc.; equipment with significant or disfiguring cosmetic flaws will be rejected.

2.2 CABLE

A. General

1. Conductor jackets shall be color-coded to enable consistent polarity.
2. Use plenum rated cable where required by code.
3. Cables noted are referenced for minimum level of quality.

B. Acceptable Manufacturers: Liberty, West Penn, Canare, Belden, Extron, Covid, and Gepco.

2.3 HARDWARE

A. Jacks and Connectors

1. Provide panel mounted isolated ground jacks.
2. Contacts are to be silver-plated, chromate dipped, phosphor bronze, or brass.
3. Install connector and jacks per manufacturer's directions.
4. Panel mounted jacks are to be recessed.
5. Acceptable Manufacturers: Panelcrafters, Neutrik, Amphenol, Extron, or Liberty.

B. Amplifier

1. Network enabled amplifier 300-800 Watts per channel at 8 Ohms or 70-volt
2. Remote control capable
3. Install per manufacturer's directions.
4. Acceptable Manufacturers: Crown, QSC and Powerlite

C. Audio Ceiling Speakers

1. 6.5” Coaxial in-ceiling speakers 8 Ohm and 70v
2. 25/70.7/100-volt tap settings
3. White finish
4. Install per manufacturer's directions.
5. Acceptable Manufacturers: JBL, Soundtube, Extron

D. Podium Equipment Cabinet (free standing)

1. 16-gauge construction
2. Locking front door
3. Casters
4. Overall Height between 24”-72” (including casters) Usable depth 24.5”
5. Harnett Regional Jetport Logo on each
6. Basis of Design: Spectrum Industries 55260 Media Director.

E. UPS

1. 1000/ 2400 Watts / 3000 VA Input 120V/Output 120V
2. (6) NEMA 5-15R, (2) NEMA 5-20R
3. Install per manufacturer's directions.
4. Acceptable Manufacturers: APC, Tripp-Lite, Leibert

F. Control System and Wireless Control Panel Display

1. Audio Video presentation control system
2. Matrix sized appropriately based on inputs and outputs required
3. Support HDMI with HDCP content
4. Digital Signal Processing Server for source audio, wireless and wired microphones
5. Support HDMI and audio from front Desk wall plate
6. All signal types shall be converted and transported as digital at highest quality possible
7. Provide HDMI video output to projectors
8. Provide audio output to amplifier and speaker systems
9. Provide integrated serial controls of projectors, screen, display panels and drapes
10. Scale all video images for highest quality display
11. Install per manufacturer's directions.
12. Acceptable Manufacturers: Crestron, or approved equal

G. Audio-visual System Face Plates

1. Provide metallic cover plates at all control, switching and jack locations. Etch and ink all system faceplates to indicate function, input/output number, etc.
2. Minimum engraved letter height 1/8 inch. Coordinate finish with the Owner. Center lettering vertically OVER or horizontally to the right of the appropriate connector. Connector mounting shall allow sufficient finger clearance for connector insertion and removal without interference from adjacent connectors.
3. Electronic Component Face Plate Labels: Provide permanent labels as specified and shown on detail drawings. Engraved plastic labels fastened with epoxy are acceptable. Tape-type labels are not acceptable.
4. Provide a neatly labeled floor plan with as-built locations of all audio-visual jacks. Locate floor plan in front cover of the equipment rack behind a clear Plexiglas cover. Minimum size of chart: 8-1/2 inches x 11 inches.
5. Provide system functional description and operating procedures for each system configuration. Place behind clear Plexiglas near each of the equipment racks. Include basic operating procedures and troubleshooting steps.

2.4 CONTROL SYSTEM PROGRAMMING

A. Contractor shall provide all keypad and control system programming to make a fully functional and working system. System functional requirements shall be as described in these documents. Provide to the Consultant all keypad designs for functional review during the construction submittal process. Budget for eight hours of keypad and system-programming changes during the system check out.

B. Program Requirements

1. The following is the minimum functionality for the project programs for the conference rooms:
   a) Volume up, down and mute for all loudspeakers
   b) Combining of both conference room's displays, audio, sound reinforcement into one room.
   c) Confidence monitor in each room.
   d) Displays turn on and off.
   e) Transport functions on all devices, play, stop, pause, fast forward, reverse, skip forward, skip back, rewind.
   f) System on/off and image mute.
   g) Selection of sources.
   h) Display power on macro when valid input is selected.
   i) Auto power down macro if a keypad button has not been pressed in 2 hours.
   j) Auto power down macro at midnight as required by owner.
   k) Control system will be connected to building data network for remote viewing via Crestron. All control units shall be coordinated with the owner's IT for IP Addressing and for VLAN Configuration.
   l) Source programing for each flat panel display including remote control of volume, channel changing and source input change.

PART 3 - EXECUTION

3.1 PHYSICAL INSTALLATION

A. Installation will include the delivery, unloading, setting in place, fastening to walls, floors, ceilings, counters, or other structures where required, interconnecting wiring of the system components, equipment alignment and adjustment, and all other work whether or not expressly required herein which is necessary to result in complete operational systems.

B. All installation practices will be in accordance with, but not limited to, the general design and construction requirements of the Owner, the general requirements of divisions 00 and 27 and all contract specifications and drawings. Installation will be performed in accordance with the applicable standards, requirements, and recommendations of National, State, and Local authorities having jurisdiction. Before commencing work, the Contractor will familiarize himself with all of these requirements.

C. If, in the opinion of the Contractor, an installation practice is desired or required, which is contrary to these specifications or drawings, a written request for modification will be made to the Owner. Modifications will not commence without written approval from the Owner.

D. During the installation, and up to the date of final acceptance, the Contractor will be under obligation to protect his finished and unfinished work against damage and loss. In the event of such damage or loss, Contractor will replace or repair such work at no cost to the Owner.

3.2 PHYSICAL INSTALLATION

A. All equipment will be firmly secured in place unless requirements of portability dictate otherwise. Fastenings and supports will be adequate to support their loads with a safety factor of at least five.

B. All boxes, equipment, etc., will be secured plumb and square. In the installation of equipment and cable, consideration will be given not only to operational efficiency, but also to overall aesthetic factors.

3.3 CABLE INSTALLATION

A. All cables, regardless of length, will be marked with wrap-around number or letter cable markers at both ends. There will be no unmarked cables at any place in the system. Marking codes used on cables will correspond to codes shown on drawings and or run sheets. All inter-rack cabling will be neatly strapped, dressed, and adequately supported.

B. Terminal blocks, boards, strips, or connectors, will be furnished for all cables which interface with racks, cabinets, consoles, or equipment modules.

C. No audio cables will terminate directly to the audio patch panel jacks. Each audio patch panel will be furnished with an audio terminal block and all audio cables to and from the audio patch panel will terminate on this block.

D. All cables will be grouped according to the signals being carried. In order to reduce signal contamination, separate groups will be formed for the following cables:

1. Electrical power
2. Control & Networking
3. Video
4. Audio

E. As a general practice, all power cables, control cables and high level cables will be run on the left side of an equipment rack as viewed from the rear. All other cables will be run on the right side of an equipment rack, as viewed from the rear.

F. Code and owner requires the Contractor to use CL2P, plenum rated cables where home run conduits are NOT provided for the audiovisual system or above finished ceilings.

G. All cables (except video and pulse cables which must be cut to an electrical length) will be cut to the length dictated by the run. No splices will be permitted in any pull boxes without prior permission of the Owner. For equipment mounted in drawers or on slides, the interconnecting cables will be provided with a service loop of appropriate length.

H. No cable will be installed with a bend radius less than that recommended by the cable manufacturer.

I. Provide certification documentation that the Contractor has tested their installed wiring and connectivity per industry standards, specifically telecommunications cabling e.g. Category STP and optical fiber cabling.

J. All terminations and cabling will be neatly dressed, properly labeled using nylon wire ties.

3.4 GENERAL SYSTEMS

A. The following is required for acceptance of the audio-visual system by the Owner:

1. Install complete and functioning audio-visual system.
2. Label equipment and cables corresponding to functional diagram.
3. Conduct adjustments and preliminary testing.
4. Report results of preliminary testing along with system documentation.
5. Participate in acceptance test and deliver final system and documentation.
6. Conduct any adjustments or re-testing required to meet the performance specifications.
7. Provide training to an individual(s) designated by the owner/Architect/Consultant.

3.5 AUDIO-VISUAL OPERATIONAL REQUIREMENTS

A. Care shall be taken to eliminate electro-magnetic radio frequency and electro-static interference; the system shall be free of audible hum, rattles, buzzing sounds, distortion and visible hum bars or distortion.

3.6 OWNER PERSONNEL TRAINING

A. As part of Work of this Section, provide a total of 8 hours of on-the-job training for personnel, designated by the Owner for instruction, in the proper operation and maintenance of the systems. This training shall take place after the installation is operational but before the acceptance testing, in (two) four-hour blocks.

B. Provide the additional 4 hours of training in a minimum of two-hour blocks during the first year after the system has been accepted. These training sessions are at the request of the owner.

C. Provide one initial set of manuals for the system as described in this specification at the time of training for review and comment by the owner’s personnel.

3.7 PERFORMANCE SPECIFICATIONS

a. Image size and clarity: Mount the displays as indicated on the drawings and project the image onto the displays using a test computer. Projected images shall be of maximum width and maximum height, centered on the display. Image tests shall utilize standard AMI test slides and similar video media to establish any image sizes on the display.

b. Geometric Distortion: Shall be corrected using physical and/or optical adjustment only. Electronic or digital correction should be used only when called for by the design intent.

c. Control functions: Demonstrate that each of the controlled devices may be controlled either at the individual device or through the use of the remote control system and that all individual devices and combinations of devices may be utilized in the logical and common formats and that all systems are in proper working order.

3.8 CONTRACTOR'S TESTING AND ADJUSTMENTS

a. Furnish all equipment and personnel to conduct these tests in accordance with the performance specification requirements.

b. All timing and gain measurements shall be made while the operator controls of the device under test are set in the center-of-travel, in bypass, or at the manufacturer’s detent position. Any adjustments should be made by modification of cable length or internal adjustments.

c. Display System Testing

1. Use standard test charts to provide uniform alignment and focus across the field of the image.
2. Setup display geometry for all popular HD, HDMI, Apple display modes and other specific scan modes as directed by the Owner.

D. Controls: Adjust all controls to achieve the specified performance. Provide shaft-locks or covers for all level controls, as appropriate to prevent unauthorized gain changes. All control knobs; sliders, etc should be marked to show their final settings so they may be reset to the correct settings in the event they are adjusted in the future.

E. Wireless Systems: Ensure that all wireless systems operate on different frequencies from each other and from any other transmitters in the area.

F. Report: Prepare a letter/report documenting the results of these tests and readings. Include final equalizer and gain settings for review by the Design Consultant.

3.9 ACCEPTANCE TESTS

a. Provide a STATEMENT OF COMPLETION, certifying that the system is installed and is ready for acceptance testing by the Design Consultant.

b. Qualification for Acceptance: After completing preliminary testing, Contractor shall furnish the Owner/Design Consultant with copies of As Built documentation as required in this Specification.

c. Furnish a technician who is familiar with the system to assist the Design Consultant during the acceptance testing and equalization for the duration it takes to complete the adjustments (regular time or overtime as required). A minimum of 24 hours are required to complete the adjustments.

d. Acceptance Test: The Owner and Design Consultant shall be present during the acceptance testing and require the assistance and cooperation of the Contractor.

1. Each major component shall be demonstrated to function.

2. Measurements: Electrical, optical and acoustical measurements may be performed at the discretion of the Owner and/or their representatives. Contractor shall provide equipment for performing any necessary electrical test or adjustments.
3. Operating tests may include use of any individual or combination of systems provided and from any control location.
4. Each cable may be inspected for proper termination.
5. Under the direction of the Design Consultant, adjust signal levels and loudspeaker aiming, as required, to achieve the uniform sound distribution required by this Specification.

F. Such tests may be performed on any piece of equipment or system.

1. If any test shows the equipment or system is defective or does not comply with the Specifications, Contractor shall perform any remedies, at their expense, and pay the subsequent expenses of any re-testing required.

G. Contractor shall provide a final report, which will document the final equipment settings and adjusted levels and values.

H. If the system does not meet criteria or if additional trips to the JOB SITE for testing or adjustment are required, the Contractor shall reimburse the Owner for all expenses and professional time encountered by the Design Consultant/Architect.

3.10 BIDDING INSTRUCTIONS

a. All equipment substitutions must be equal to or better fully functional replacements of the specified items. This includes items such as rack mounting requirements, software operating requirements, functional features, maintenance features and warranty length.

3.11 BID FORM

a. Provide the following documentation with your bid:

1. Refer to bid submittal section 1.6.b for bid submittal requirements. Attach all required information.
2. Provide a schedule indicating the number of workdays to install the system after each major sign-off by the Owner (i.e., after the bid is awarded, how many days to submit shop drawings, how many days after approval of shop drawings prior to construction, etc.) through the end of the project. Schedule shall be broken down as required by bidding firm's policies.
3. Provide a copy of your standard contract for materials and installation services.
4. A statement indicating all equipment is readily available. If not, provide a recommended solution as an alternate.
5. Provide a bid for to install a complete and operational system. "Complete and operational" is defined as tested and adjusted per design documents.
6. Complete bid form information called out in parts of this specification.
7. Return additional completed copies of this bid form and all resume documentation as required by the bidding instructions issued with this document.

3.12 PRICE BREAKDOWN

a. Provide Unit Cost for each item.

b. Provide a list of other equipment and hardware required for a complete and working system.

c. Provide Total Line Cost for each item based on quantity.

END OF SECTION 27 40 00

SECTION 28 10 00 – ACCESS CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The Access Control System shall control and monitor portals in the terminal and process areas, office areas, and secure core space. The access control shall provide access control, badging, and monitoring functions as well as integrate to the Video Management System (VMS) as well as other systems as specified. Smart Cards shall be utilized along with an individualized PIN to require two forms of credentials at each access point.

B. The access control shall provide access control, badging, and monitoring functions as well as integrate to the Video Management System (VMS) as well as other systems as specified. Smart Cards shall be utilized.

C. Harnett Regional Jetport has an existing LenelS2 OnGuard access control system. This system shall remain and be the access control application. The contractor shall be an LenelS2 certified security installer.

D. The Contractor shall provide LenelS2 licenses for each door for use in the existing LenelS2 OnGuard Access Control system.

1.2 RELATED SECTIONS

A. See Specification 27 01 00.

1.3 REFERENCES

A. See Specification 27 15 00. In addition, the following shall apply:

B. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
   1. National Institute of Standards and Technology (NIST) 800 series.
   2. Integrated Security System Standard for Airport Access Control, RTCA /DO230B dated June 19, 2008
   3. HSPD-12 – Homeland Security Presidential Directive 12: Policy For a Common Identification Standard for Federal Employees and Contractors – August 27, 2004

1.4 DEFINITIONS

See Specification 27 15 00 Section 1.3.

1.5 SYSTEM DESCRIPTION

A. General: All systems will comply with HSPD-12, FIPS Pub 201 policies, Government Smart Card Interoperability Specification (GSC-IS V2.1) and GSA Schedule 70 for products and services.
   1. Appoved Vendors: Refer to the following website for a list of qualified vendors of HSPD-12 equipment:
      a. Http://fips201ep.cio.gov/apl.php

B. General: The Access Control System is an existing LenelS2 OnGuard system. The contractor responding shall be certified in LenelS2 OnGuard.

C. Contractor shall provide software license capable of supporting the quantity of readers, as required to support the actual quantity of portals, card readers, input and output points, as designed and installed as part of this contract. The contractor shall provide not less than five (5) additional licenses for card readers, access points, etc. above and beyond what is indicated in specifications and drawings.

D. Transportation of digital signals for communications between field panels and the access control host shall be via the SECURITY LAN being provided by the contractor. Coordinate IP addressing, Ethernet switch port counts and assignments, long-term storage requirements and bandwidth utilization with the contractor providing and configuring the dedicated security LAN. Include cost for this coordination in the cost of this contract.

E. Contractor shall provide a minimum of one-hour stand-by battery run time for all field panels, network switches and lock power supplies. Batteries shall be supervised for failures while on primary power. Battery failure outputs and low battery conditions shall be connected to the access control to notify the system of the failure. Primary power shall be supervised to indicate an "on battery" condition to the system.

F. Work of this section includes all labor, materials, and software required for detailed technical design, systems, installation, data entry and importation, programming, graphic entry and importation, testing, commissioning, documentation and warranty of a complete and operating Access Control System as shown on the drawings and specified herein.

G. This contract includes all work necessary for a fully functional access control system for the Terminal and secure areas. Work includes but is not limited to: furnishing all equipment, cabling, installation, programming, and testing of all devices.

H. Door hardware and conduit rough-in has been provided by others and this contractor shall coordinate with all other trades, contractors, general contractors, and projects as needed for a fully functional system.

1.6 PURPOSE

A. The purpose of the access control is to ensure following:
   1. Access by authorized individuals to Secure and SIDA areas, and any other areas the airport may designate.
   2. Prevention of unauthorized access by inadvertent means or unauthorized individuals.

3. Assure that an individual is immediately denied entry to a specified area when that person's access authority for that area is withdrawn.
4. Archiving of all access and alarm events providing audit trails for all these events.
5. Timely notification to airport authorities of all off-normal events or alarmed events.
6. Utilize existing ID badges for personnel working at the airport terminal.

1.7 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specifications Sections.

B. Shop Drawings: Provide shop drawings showing equipment/locations, and arrangements.

1.8 QUALITY ASSURANCE

A. Contractor: the Contractor must have been in the business of selling and installing similar systems for a minimum of five (5) years. The Contractor shall have been actively engaged in installing, maintaining and operating similar systems and services as outlined in this document. The Contractor shall have a minimum of three (3) sites that are actively using the same system with the same version of the software, and each of those sites must be currently in operation, and have been in operation for at least the proceeding twelve (12) months. The Contractor shall submit information regarding a minimum of three (3) reference sites that are actively using the systems proposed by Contractor.

B. The Contractor shall include eight (8) hours of on site assistance (excluding travel time) to be used after the final acceptance of the system. This assistance time is in addition to Warranty services and shall be performed on an on-call basis at the Owner's request. The Contractor shall upgrade each software package and firmware (where applicable) used in the system to the latest version by the end of the warranty.

C. The Contractor shall offer an "Optional One (1) Year Extended Warranty" package renewable for up to three (3) years to the Owner as shown in the unit pricing Section. The Owner shall inform the Contractor of the acceptance or rejection of the first year of the package at the time of final acceptance.

D. NEC Compliance: Comply with NEC as applicable to construction and installation of security system components and accessories.

E. UL Compliance and Labeling: Provide system components, which are UL-listed and labeled.

1.9 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 17 1500 Section 1.8.

1.10 WARRANTY

A. See Specification Section 17 1500 Section 1.6.I.

B. Period: The Contractor shall guarantee all labor, workmanship, and materials for a period of one (1) year from the date of final acceptance or opening day – whichever occurs last. Should a failure occur within the first year to the system, the Contractor shall provide all labor and materials necessary to restore the system to the condition required for the final test and acceptance for this Contract, at no cost to the Owner. When spare equipment is used to provide system fixes, the Contractor shall replace spare equipment used in order to maintain a constant on-site spare parts inventory. Warranty work shall include preventative and routine maintenance work in addition to emergency warranty work. Emergency warranty work shall include the repair or replacement of components which fail during the warranty period excluding equipment damaged or rendered unserviceable due to apparent and provable misuse, abuse, vandalism or negligence by Airport employees or the using public. Apparent and provable as used herein shall mean that the physical evidence indicates what and who caused the damage, e.g., lightning strike, vehicular damage, someone other than the Contractor's technician, etc.

C. Extended Warranty/Maintenance Agreement: Contractor shall provide, as a separate line item cost in their proposal, a price for an extended Warranty and Operations Maintenance Services Agreement for all of the access control System as a whole.

1.11 TRAINING

A. Provide system operation and administration/ maintenance training for Airport personnel. Two (2) categories of system training shall be provided. System operational training and administration/ maintenance training shall be provided. Training shall be provided multiple times and at the intervals specified below. For each time that training is provided, two (2) sessions of each category of training shall be held. One (1) session shall be provided during daytime working hours, and one session during evening working hours, with specific days, work shifts, and hours for training to be selected by the Airport. Training must be in a modular format and shall provide separate areas of training materials specific to administration, operation, and maintenance. Training materials shall be provided to the Airport ten (10) working days in advance of the training courses. Training sessions and intervals shall be as follows:
   1. System Pre-Acceptance training – shall be provided two (2) weeks before acceptance testing and system utilization by the Airport.
   2. Follow-up Training Session – shall be provided between fifteen (15) and sixty (60) days after pre-acceptance training, with times and dates to be selected by the Airport.

1.12 OPERATION AND MAINTENANCE MANUAL

A. See Specification Section 17 1500 Section 1.6.

1.13 MAINTENANCE AND SUPPORT

A. See Specification Section 17 1500 Section 1.6.

1.14 SYSTEM REQUIREMENTS

A. General: The Access Control System is an existing LenelS2 OnGuard system. The contractor responding shall be certified in LenelS2 OnGuard.

1.15 HARDWARE ARRANGEMENTS

A. The names assigned to the equipment in this section and the methods are intended to describe a generic, distributed intelligence access control component. The names are not intended to prevent the contractor from bidding any systems that may have different architectures than those described in the following specifications. The intent is to create a hierarchy of components that allow for a distributed intelligence such that the granted/denied decision can be made locally without having to access the head-end for every transaction. The intent of this specification is to utilize the LAN Room created as part of the base building project that will house the Field Panels and the associated portal interface panels or modules. The use of field modules at the portals or in the field does not meet the intent of this specification.

B. Contractor shall provide a 48-port 10/100/1000 Ethernet switch with PoE+ power and UPS.

C. Intelligent Field Panels: (IFP) A distributed intelligence processor that stores the cardholder database to grant or deny access, monitors system activity, and provides data communications interface between Input/Output Panels and the access control System Host CPUs via Ethernet connection. This device is intended to be located in the telecom room and connected via a contractor-provided Category 6 cable to the security cabinet.

D. Portal Interface Panel or Module: A passive junction point that connects the portal devices into the access control System.

E. Input/Output Panel or module: A modular card that provides for input and output device connection to the access control System. This device is intended to be located in the LAN Room.

F. Card Reader: A portal device to read encoded portable credentials.

G. Keypad: A portal device to send keypad code entered into the system for the purpose of determining access rights.

H. Magnetic Locks: A device to secure the portal and allow passage through the portal by means of remote control.

I. Electric Strike (ES): A device to secure the portal and allow passage through the portal by means of remote control.

J. Balanced Magnetic Switch (BMS): A UL 634 Level 2 device used to monitor the open/closed status of the portal.

K. Lock Status Switch: A device used to monitor secured/unsecured status of the portal. For magnetic type locks, this is often referred to as a bond sensor.

L. Request to Exit Device: A device used to allow egress through a secured portal without creating an alarm condition.

M. Audible/Visual Alarm: A device used to indicate a breached security condition at the portal. This usually consists of an audible device (horn) and a visual device (strobe).

1.16 SYSTEM ARCHITECTURE

A. General: General: The Access Control System is an existing LenelS2 OnGuard system. The contractor responding shall be certified in LenelS2 OnGuard.

1.17 SOFTWARE REQUIREMENTS

A. General: General: The Access Control System is an existing LenelS2 OnGuard system. The contractor responding shall be certified in LenelS2 OnGuard.

1.18 FUNCTIONAL REQUIREMENTS

A. General: The Access Control System is an existing LenelS2 OnGuard system. The contractor responding shall be certified in LenelS2 OnGuard.
   1. Server Configuration: The existingserver shall be mounted in the Telecom Room 120 with any required rails and supports. Coordinate cabinet size with Division 27.

1.19 APPLICATION DESIGN

A. General: The Access Control System is an existing LenelS2 OnGuard system. The contractor responding shall be certified in LenelS2 OnGuard.

1.20 INTERNAL SYSTEM SECURITY PROVISIONS

A. Supervised Wiring: Selected field wiring shall be supervised. Cutting, shorting or altering connections of any wire listed as supervised below shall be detected, and activate an alarm condition at system workstations. Provide wiring supervision for the following functions:
   1. Tamper Switches.
   2. Panic alarms.
   3. Balanced Magnetic Switches.

B. Multiple Contractor User privilege levels will likely be established during the installation and testing periods of this Project. As a condition of system final acceptance, all Contractor User privileges shall be removed from the system, unless otherwise authorized in writing, by the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. Power: All access control equipment shall operate on 120-VAC or PoE (Power over Ethernet Protocol). Any special power treatment required, such as filtering or spike elimination that may be required for proper operation and protection of the access control system, shall be provided with the system. The project site is in an area prone to lightning. Contractor shall provide lightning surge suppressors on all exterior copper circuits to prevent lightning damage to the equipment.

B. Backup Power: access control field equipment shall be supplied from supervised power supplies with battery backup. Power supplies shall be located within communication room and shall be tied onto the emergency power circuits access control servers shall be fed from UPS units. Both UPS and power supplies with battery back up methods shall provide for a minimum of (1) one hour with 100% spare capacity for future growth.

C. Hardware: Provide a distributed access control system as required for a complete operating system as described herein and shown on the Drawings.

2.2 MANUFACTURERS

A. General: The Access Control System is an existing LenelS2 OnGuard system. The contractor responding shall be certified in LenelS2 OnGuard.

B. TWIC and FIPS 201 COMPLIANCE

C. General: The Access Control System is an existing LenelS2 OnGuard system. The contractor responding shall be certified in LenelS2 OnGuard.
   a. The contractor shall provide 100 cards (credentials)

D. Manufacturers: Subject to compliance with requirements, suggested products by the following:
   1. Access Control System (software, controllers, and modules):
      a. LenelS2 – Harnett Regional Jetport existing system.
      b. No other options

   2. Card Readers:
      a. LenelS2 – Harnett Regional Jetport existing system.
      b. No other options
   3.
   4. Flush Mounted balance magnetic switches:
      a. GE Security – Sentrol

   5. Surface and special application security switches:
      a. GE Security – Sentrol

   6. Power Supplies (controller, module, and door hardware):
      a. Alarm Safe.
      b. Altronix

   7. Intercom
      a. AiPhone
      b. Gai-tronics
      c. Talk-a-phone

   8. Visual and/or Audible Devices:
      a. Wheelock
      b. Pre-approved equal

2.3 SPARE PARTS

A. The Contractor shall furnish spare parts for the access control system. The intent of the spare parts inventory is to allow the immediate replacement of failed or faulty components to the lowest level of field repair to maintain system-operating integrity. Any spare parts used throughout the duration of this Project shall be replaced prior to final acceptance. Furnish spare parts as follows:
   1. Processing Devices – Communications Control Panels, furnish one (1) spare.
   2. Processing Devices – Intelligent Field Panels, furnish one of each type used in the Project.
   3. Processing Devices –Portal Interface Panels, furnish two (2) of each type used in the Project.
   4. Processing Devices – Input/Output Panels, furnish one of each type used in the Project.
   5. Power supplies - furnish one of each type used in the Project
   6. Devices - furnish one of each type used in the Project.

2.4 PROCESSING DEVICES

A. Field panels: The Intelligent Field Panel (IFP) shall be a distributed intelligence processor and may include single or multi-door portal interface functionality. The field panel database shall be downloadable from the AODB. Processing tasks shall consist of access decisions; sensor shunting, input/output relationships and audit trail reporting. The field panel will communicate with the host CPU using the Ethernet LAN. The intelligent field panel shall respond to communications polling from the host CPU. If any panels fail the poll/response cycle, alarm data shall immediately be transmitted to the host CPU. Upon re-establishment of the link, event history files from the field panel shall be uploaded to the host CPU. The field panel shall store all system events in a history file, which shall be transmitted to the host CPU either on demand or automatically when event memory reaches approximately eighty-five percent (85%) capacity. Critical alarms shall be immediately processed at the field panel and transmitted along with the current history file, to the host CPU.

2.5 ACCESS CONTROL SYSTEM DEVICES

A. Smart Card Reader: Provide contactless smartcard reader.

B. Smart Card Readers with Keypad: Provide contactless smartcard reader/pin pads with the following characteristics:
   1. HID iClass or DESFire compliant contactless smartcard reader
   2. FIPS 201 compliant hardware platform
   3. Encryption: Triple DES or equal
   4. Read Range: typical 1-inch, no less and ½-inch
   5. ISO card compatibility:
      a. Audible/Visual Alarm Units: Provide alarm indicator units at the door locations indicated in the drawings.
      b. Power Supplies: Power supplies (for active components and field devices): Power supplies shall be located as needed per successful vendors' system architecture.

PART 3 - EXECUTION

3.1 INSTALLATION OF SECURITY SYSTEMS

A. General: The Contractor shall investigate the Site and become thoroughly familiar with the construction site. The Contractor shall plan the new access control installation such that the new access control system processing components are installed and tested for proper communications before any portal or door is put under control of the new access control system.

B. Install security system in accordance with equipment manufacturer's written instructions and complying with applicable portions of NEC and NECA's "Standard of Installation".

3.2 INSTALLATION OF CONDUCTORS

A. General: Installation of conductors shall comply with Division 27 Specification 1500 “Structured Cabling System”, and meet all applicable manufacturer recommendations, local, state and national codes.

3.3 GROUNDING

A. Cable Shields: All coax shields and pair shields shall be grounded at one (1) point only. Cables that originate from processing equipment and serve field devices shall be grounded to the signal ground terminal in the processing equipment.

3.4 FINAL TESTING AND ACCEPTANCE

A. The Contractor shall develop a Final Test and Acceptance plan. The plan shall identify each component of the system, intent of test, method or methods of test and expected results. Each component listed in the plan shall include space for test party signatures, brief comments, time of test and pass/fail check boxes. The plan shall be submitted to the Owner for approval or comment. When Owner Test and Acceptance Plan comments are satisfied and the system is operational, the testing may begin. The component tests shall be compared to the transaction log for accuracy, queries shall be made to narrow the test report to the test cards, card holders, operator responses and portals involved in the test. All components must be checked “pass”, signed by all parties and agree with the transaction log to be complete.

3.5 ACCEPTANCE

A. System warranty shall not start until acceptance. Acceptance will be withheld until the following activities have been successfully completed:
   1. Acceptance of all submittals.
   2. Delivery of final documentation.
   3. Successful training and demonstration, including operation of system using the manuals and demonstration of fully functional system with interfaces.
   4. Purging of Contractor User privileges.

END OF SECTION 28 10 00

SECTION 28 23 00 VIDEO MANAGEMENT SYSTEM (VMS)

PART 1. GENERAL

1.1 DESCRIPTION

A. General Description: This specification section covers the furnishing and installation surveillance cameras to be added to the existing Ubiquiti UniFi video recorder.

B. Contractor shall coordinate and furnish licenses and install VMS hardware devices, mounting brackets, power supplies, and other components of the system as shown and specified.

C. Furnish and install special boxes, miscellaneous cable, connectors, wiring, and other accessories necessary to complete the system installation.

D. Outlets, junction boxes, pull boxes, conduit, connectors, wiring, and other accessories necessary to complete the system installation, will be provided in accordance with the projects' Division 26, Electrical Work specifications, and coordinated with VMS requirements.

1.2 QUALIFICATIONS

Provide the work in accordance with Section 28 10 00, Security System General Requirements.

1.3 GENERAL CONDITIONS

In accordance with Section 28 10 00, Security System General Requirements

1.4 RELATED WORK

In accordance with Section 28 10 00, Security System General Requirements

1.5 APPLICABLE PUBLICATIONS

In accordance with Section 28 10 00, Security System General Requirements

1.6 PRECEDENCE

Obtain, read and comply with General Conditions and applicable sub-sections of the contract specifications. Where a discrepancy may exist between any applicable sub-section and directions as contained herein, this section shall govern.

1.7 SHOP DRAWINGS & EQUIPMENT SUBMITTAL

In accordance with Section 28 10 00, Security System General Requirements

1.8 OPERATING AND MAINTENANCE MANUALS

In accordance with Section 28 10 00, Security System General Requirements

1.9 WARRANTY

In accordance with Section 28 10 00, Security System General Requirements

1.10 SERVICE AND MAINTENANCE

In accordance with Section 28 10 00, Security System General Requirements

1.11 TRAINING

In accordance with Section 28 10 00, Security System General Requirements

1.12 OWNER'S RIGHT TO USE EQUIPMENT

The Owner reserves the right to use equipment, material and services provided as part of this work prior to Acceptance of the Work, without incurring additional charges and without commencement of the Warranty period.

1.13 TECHNICAL REQUIREMENTS, VIDEO SURVEILLANCE

SYSTEM A. General

1. The Harnett Regional Jetport has an existing Ubiquiti UniFi Network Video Recorder. This scope of work is limited to the providing and installing additional cameras and licenses within the existing server. Contractor shall provide equipment, miscellaneous wiring and software programming as necessary to provide a complete system as described herein and as shown on the drawings.

2. Contractor shall be responsible for providing equipment, licenses and software to achieve the specified system performance described herein.

B. Purpose

1. The System shall provide the ability to record images received from cameras located throughout HRJ facility in a digital format.

2. The System shall allow operators to view live video images in single and multiple-camera formats and retrieve the recorded video information, based on parameters requested by the user.

C. Environment

1. The Harnett Regional Jetport has an existing Ubiquiti UniFi Network Video Recorder. This scope of work is limited to the providing and installing additional cameras and licenses within the existing server. Contractor shall provide equipment, miscellaneous wiring and software programming as necessary to provide a complete system as described herein and as shown on the drawings.

3. Coordinate with division 27 15 00 contractors to locate all camera in cabinet. Provide PoE switch in each cabinet for all network cameras.

D. Attributes

1. General

a. The Harnett Regional Jetport has an existing Ubiquiti UniFi Network Video Recorder. This scope of work is limited to the providing and installing additional cameras and licenses within the existing server. Contractor shall provide equipment,

miscellaneous wiring and software programming as necessary to provide a complete system as described herein and as shown on the drawings..

c. Field Components: Field Components shall comprise TCP/IP video cameras, positioning devices, lenses, camera mounts and housings and other video system devices and miscellaneous wiring as described herein and shown on the drawings.

2. Integrated Video Management System

a. The Harnett Regional Jetport has an existing Ubiquiti UniFi Network Video Recorder. This scope of work is limited to the providing and installing additional cameras and licenses within the existing server. Contractor shall provide equipment, miscellaneous wiring and software programming as necessary to provide a complete system as described herein and as shown on the drawings.

PART 2. PRODUCTS

2.1 GENERAL

Product Acceptability: The Products section contains lists of acceptable products. If product substitutions are proposed, they must be made based upon a comparison of equivalence to the product specified. Considerations may include but shall not be limited to functional, physical, aesthetic and/or interface aspects. The Owner shall be the sole judge of whether or not a submitted substitution is deemed to be "equivalent" to that specified.

2.2 VIDEO SURVEILLANCE (VMS)

A. Approved Manufacturers:

1. The Harnett Regional Jetport has an existing Ubiquiti UniFi Network Video Recorder. This scope of work is limited to the providing and installing additional cameras and licenses within the existing server. Contractor shall provide equipment, miscellaneous wiring and software programming as necessary to provide a complete system as described herein and as shown on the drawings.

B. Video Cameras

1. All video cameras shall be Ubiquiti UniFi Digital Video cameras or approved equivalent as shown on the design drawings.

PART 3. EXECUTION

3.1 GENERAL

In accordance with Section 28 10 00, Security System General Requirements.

3.2 SYSTEM CONFIGURATION:

A. Camera recording and display configurations shall be arranged via a combination of the Video Server and LAN/Wireless LAN network.

B. Contractor shall coordinate with the Owner to determine the required pre-programmed

surveillance and event-initiated configurations.

3.4 EQUIPMENT, RACK AND CONSOLE INSTALLATION

All server equipment shall be housed in each cabinet.

3.5 GROUNDING PROCEDURES

Provide grounding of all systems and equipment in accordance with Section 28 10 00, Security System General Requirements.

3.6 WIRE AND CABLE INSTALLATION PRACTICES

Provide only miscellaneous wire and cable installation in accordance with Section 27 10 00, Structured Cabling General Requirements.

3.8 START-UP RESPONSIBILITY

Provide start-up services for all systems and equipment in accordance with the manufacturer's recommendations.

3.9 PRELIMINARY INSPECTION AND TESTING

Provide preliminary inspection and testing services for systems and equipment in accordance with Testing and Commissioning, Section 28 10 00.

3.10 SYSTEM PERFORMANCE TESTING AND ADJUSTING PROCEDURES

A. Provide performance testing, burn-in, and adjusting of systems and equipment in accordance with Testing and Commissioning, Section 28 10 00.

B. VMS Performance Testing

1. Demonstrate acceptable picture quality and camera views on each camera.
2. Demonstrate acceptable picture quality on each video monitoring workstation, and display devices accessible over the Wireless LAN.
3. Demonstrate no tearing of video is observed while Pan-Tilt –Zoom cameras are being repositioned.
5. Demonstrate camera positioning functionality, on pan/tilt/zoom cameras, throughout the entire range of possible camera positions.
6. Ensure primary views are acceptable. Demonstrate the view obtained by each pre-programmed camera position.
7. Demonstrate automatic event-initiated recording sequences, including camera pre-positioning, where applicable.

3.11 BURN-IN PERFORMANCE PERIOD

Provide a burn-in performance period to demonstrate the stability of the system, in accordance with the manufacturer's recommendations.

3.12 COMMISSIONING AND VALIDATION

A. Provide commissioning and validation services to prove and improve the effectiveness of the

system, in accordance with the manufacturer's recommendations.

B. Coordinate with the Owner, or the Owner's representative, for the provision of these services.

3.13 FINAL PROCEDURES

Perform final procedures in accordance with the manufacturer's recommendations.

END OF SECTION 28 2300

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil treatment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include the EPA-Registered Label for termiticide products.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Soil Treatment Application Report: Include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

C. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located and who employs workers trained and approved by manufacturer to install manufacturer's products.

1.5 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites, including Formosan termites (Coptotermes formosanus). If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.
   1. Service Life of Treatment: Soil treatment termiticide that is effective for not less than three years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated.

3.2 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.

   1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
   2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.
   3. Crawlspaces: Soil under and adjacent to foundations. Treat adjacent areas, including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
   4. Masonry: Treat voids.
   5. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.

B. Post warning signs in areas of application.

C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116

SECTION 321720 – DETECTABLE WARNING SURFACES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cast in place detectable warning surfaces at exterior sidewalks.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.

B. Samples for Verification Purposes: Submit two (2) tile samples minimum 6"x6" of the kind proposed for use.

C. Shop drawings are required for products specified showing fabrication details, composite structural system, tile surface profile, sound on cane contact amplification feature, plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.

D. Material Test Reports: Submit complete test reports from qualified accredited independent testing laboratories to qualify that materials proposed for use are in compliance with requirements and meet or exceed the properties indicated on the specifications. All tests shall be conducted on a Cast In Place Detectable/Tactile Warning Surface Tile system as certified by a qualified independent testing laboratory and be current within a 24 month period.

E. Maintenance Instructions: Submit copies of manufacturer's specified installation.

1.3 QUALITY ASSURANCE

A. Provide Cast In Place Detectable/Tactile Warning Surface Tiles and accessories as produced by a single manufacturer with a minimum of three (3) years experience in the manufacturing of Cast In Place Detectable/Tactile Warning Surface Tiles.

B. Installer's Qualifications: Engage an experienced Installer certified in writing by Cast In Place Detectable/Tactile Warning Surface Tile manufacturer as qualified for installation, who has successfully completed installations similar in material, design, and extent to that indicated for Project.

C. Americans with Disabilities Act (ADA): Provide Cast In Place Detectable/Tactile Warning Surface Tiles which comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act (Title III Regulations, 28 CFR Part 36 ADA STANDARDS FOR ACCESSIBLE DESIGN, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES).

1.4 DELIVERY, STORAGE AND HANDLING

A. Cast In Place Detectable/Tactile Warning Surface Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy plastic wrappings to protect tile from concrete residue during installation and tile type shall be identified by part number.

B. Cast In Place Detectable/Tactile Warning Surface Tiles shall be delivered to location at building site for storage prior to installation.

1.5 SITE CONDITIONS

A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in spaces to receive Cast In Place Detectable/Tactile Warning Surface Tiles for at least 24 hours prior to installation, during installation, and for not less than 24 hours after installation.

B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the general public. Provide barricades or screens to protect the general public.

1.6 GUARANTEE

A. Cast In Place Detectable/Tactile Warning Surface Tiles shall be guaranteed in writing for a period of five (5) years (minimum) from date of final completion. The guarantee includes defective work, breakage, deformation, fading and loosening of tiles.

PART 2 - PRODUCTS

2.1 DETECTABLE WARNING SURFACES

A. Cast in place composite paver unit with the following attributes
   1. Compliant with ADAAG R304 Regulations for Detectable Warning Surfaces.
   2. Raised truncated domes with a diameter of 0.9”, height of nominal 0.2” and a center-to-center spacing of 1.67” minimum to 2.35” maximum.
   3. 2’ deep by full width tactile required unit measuring 0.25” nominal thickness with embedment ribs 3” on center. Confirm width and quantities on drawings. Layouts comprised of smaller tiles to achieve full width will not be accepted.
   4. Homogeneous glass and carbon reinforced composite which is colorfast and UV stable suitable for exterior use.
   5. Durable fiberglass reinforced truncated domes.
   6. Uniform color throughout without an applied paint coating.
   7. Color to be selected by Architect from manufacturer’s full palette of standard colors.

B. Attributes:
   1. Compressive strength: 28,900 psi in accordance with ASTM D 695.
   2. Flexural strength: 29,300 psi in accordance with ASTM D 790.
   3. Water absorption: 0.07% in accordance with ASTM D 570.

4. Slip resistance: 1.18 Dry, 1.05 wet in accordance with ASTM C 1028.
5. Flame spread index: 20, in accordance with ASTM E 84.
6. Salt spray: No change (200 hours) in accordance with ASTM B 117.
7. Chemical stain testing: no deterioration in accordance with ASTM 1308.
8. Abrasion resistance: 549 in accordance with ASTM C 501.
9. Accelerated weathering: Delta E <5.0 (2,000 hours) in accordance with ASTM G 155.
10. Tensile strength: 11,600 psi in accordance with ASTM D 638.
11. Load bearing at 16,000 lbs: No damage in accordance with AASHTO-H2O.
12. Freeze/Thaw/Heat: No disintegration in accordance with ASTM C 1026.

C. Subject to compliance with requirements, provide products from one of the following manufacturers:
1. ADA Solutions, Inc.
2. Armor-Tile.
3. Detectable Warning System.
4. Tile Tech Pavers

PART 3 - EXECUTION

3.1 DETECTABLE WARNING SURFACE INSTALLATION

A. Comply with manufacturer’s standard installation instructions.
1. The physical characteristics of the concrete shall be as specified in the drawings while maintaining a slump range of 4-7 to permit the solid placement of the tactile unit in wet cement.
2. The concrete shall be poured and finished level, true and smooth to the required dimensions prior to the placement of the tactile unit.
3. Place the tactile unit 6-8 inches from the curb or sidewalk line. Working in a grid pattern, tamp the tactile unit into the wet concrete using a rubber mallet and a piece of wood. Continue this process until all of the air has been released, and the tactile unit is flush with the surrounding area. Avoid striking the surface of the tactile unit directly.
4. Following the placement, the tactile unit elevation should be checked to the adjacent surface with a straight edge. The tactile unit elevation should be consistent with the contract drawings and specifications. Any required adjustments must be made prior to the time when the concrete begins to set.
5. When the tactile unit is in place, and no further adjustments are needed, place a cinder block on both ends to hold the tactile unit in place while the concrete sets.
6. During and after the tactile unit installation, as well as the concrete curing stage, no walking or external forces can be placed on the tactile unit. The area must be protected from pedestrian traffic until the concrete is cured, approximately 1-2 hours.
7. Remove the plastic protective covering from the face of the tactile unit once the concrete is cured.

3.2 CLEANING, PROTECTING AND MAINTENANCE

A. Protect tiles against damage during construction period to comply with manufacturer’s specification.

B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

C. Clean tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tiles by method specified by manufacturer.

D. Comply with manufacturers' maintenance manual for cleaning and maintaining tile surface and it is recommended to perform annual inspections for safety and tile integrity.

END OF SECTION 321720

SECTION 323121 – PRE-ENGINEERED METAL PANEL SCREENWALL ENCLOSURE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Ornamental fixed louver modular fencing panels fabricated with extruded aluminum louvers and flat aluminum bars, including extruded aluminum fence posts and aluminum louver gates.

B. Related sections:
   1. Section 033000 - Cast-in-Place Concrete: Concrete footings for support of fence posts.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. ASTM B117 - Operating Salt Spray (Fog) Apparatus.
   2. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
   3. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   4. ASTM D822 - Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
   5. ASTM D2794 - Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
   6. ASTM D3363 - Test Method for Film Hardness by Pencil Test.

1.3 SUBMITTALS

A. Provide in accordance with Section 013300 - Submittal Procedures:
   1. Product data for components and accessories.
   2. Shop drawings showing layout, dimensions, spacing of components, [interface with electric gate operator,] and anchorage and installation details.
   3. Sample: 8 by 10 inches minimum size sample of fence panel illustrating design, fabrication workmanship, and selected color coating.
   4. Copy of warranty specified in Paragraph 1.4 for review by Architect.

1.4 WARRANTY

A. Provide in accordance with Section 017700 - Closeout Procedures:
   1. 10-year warranty for factory finish against cracking, peeling, and blistering under normal use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Total Eclipse, inclined, flanged louver blade fence system providing 100% visual blocking, as manufactured by Ametco Manufacturing Corporation, 4326 Hamann Parkway, P.O. Box 1210, Willoughby, Ohio 44096; 800-362-1360.

B. Alternate Manufacturers:
   1. Alumi-Guard.
   2. Superior Aluminum Products.

2.2 MATERIALS

A. Extruded aluminum: ASTM B221, Alloy 6063, Temper T-6.

B. Sheet aluminum: ASTM B209, Alloy 6063, Temper T-6.

C. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing additives.

2.3 FENCE SYSTEM

A. Type: Ornamental fencing system consisting of horizontal, fixed louver, modular fence panels fabricated with extruded aluminum framing bars and supported by extruded aluminum fence posts.

B. Fence panel:
   1. Fixed louver bars: Extruded aluminum louver bars, 1-31/32 inches wide, spaced at 1-13/16 inches. Extend louver flange to allow 100 percent direct visual screening.
   2. Cross bars: 1/2 by 1/8 inch flat bars welded perpendicular to back side of louver bars and spaced at 18 inches.
   3. Panel height: 96 inches.
   4. Panel width: 64-21/32.

C. Posts:
   1. Type: 3 x 3 inch extruded tubular aluminum sections with solid aluminum caps.
   2. Length: 120” min. (assumes panel height, cap, and embedment in grade).

2.4 GATES

A. Provide gates of type and size indicated on Drawings. Equip gates with manufacturer's standard hardware as required for complete functional operation.

B. Type: Hinged swinging double gate.
   1. Construction: Welded frame fabricated from extruded aluminum tubing with aluminum fixed louver panels to match fencing material. Frame size manufacturer’s standard for gate opening size shown on drawings.

2. Hardware:
   a. Hinges: Size, quantity and type as determined by manufacturer.
   b. For double gates provide padlockable, 5/8 inch diameter center cane bolt assembly and strike.

2.5 ACCESSORIES

A. Fasteners: Stainless steel bolts of type, size, and spacing as recommended by fence manufacturer for specific condition.

2.6 FACTORY FINISH

A. Aluminum fence panels and posts shall receive polyester powder coating.

B. Polyester powder coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.
   1. Minimum hardness measured in accordance with ASTM D3363: 2H.
   2. Direct impact resistance tested in accordance with ASTM D2794. Withstand 160 inch-pounds.
   3. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degrees F and 95 percent relative humidity and after 1000 hours less than [3/16 inch] [5 mm] undercutting.
   4. Weatherability tested in accordance with ASTM D822: No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted at 45 degrees.

C. Color: Selected by Architect from manufacturer's standard range.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to fabrication, field verify required dimensions.

B. Cast concrete footings in accordance with Section 033000 - Cast-in-Place Concrete as detailed on Drawings and approved shop drawings.

3.2 INSTALLATION

A. Install fencing in accordance with manufacturer's installation instructions and approved shop drawings.

B. Install fence posts plumb and level by setting post in hole cast in. Temporarily brace fence posts with 2 by 4 wood supports until concrete is set.

C. Do not install bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.

D. Secure fence panels with standard stainless steel bolts to fence posts after posts have been set in footings.

E. Gates:
   1. Install gates and adjust hardware for smooth operation.
   2. Provide concrete center foundation depth and drop rod retainers at center of double swinging gate openings.
   3. After installation, test gate. Open and close a minimum of five times. Correct deficiencies and adjust.

F. Touch-up damaged finish with paint supplied by manufacturer and matching original coating.

END OF SECTION 323121

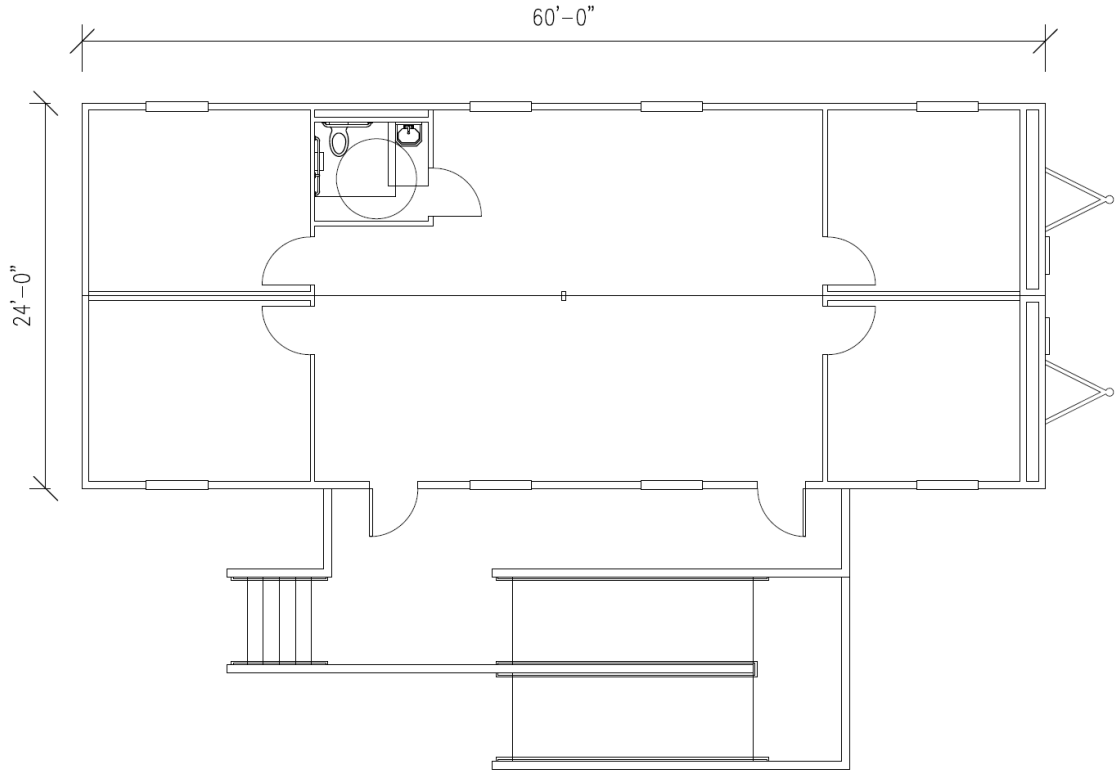
SECTION C-95

CIVIL SITE WORK CONTRACT PAY ITEMS AND CLARIFICATIONS

The purpose of this section is to provide supplemental information not covered elsewhere in the Plans and Specifications regarding civil site work contract pay items.

95-01 Temporary Terminal Rental

Prior to the Terminal Site Demolition, the Contractor is responsible for the setup of the Temporary Terminal Trailer in the location as shown on Plan sheet C-105 “Civil Temporary Terminal Site Plan”, including construction of the access walkway from the parking lot and temporary signage to the temporary terminal location from the aircraft apron, fence modifications, site grading, and drainage as shown on sheet C-104. A project submittal of the temporary trailer should be submitted for approval by the Engineer. The general layout and dimensions for the temporary trailer are shown below. All floor, wall & ceiling finishes are to be serviceable and included. Provide minimum 20 foot candle lighting in all areas/ Once the New Terminal Building is ready for occupancy, Contractor shall remove the Temporary Terminal Rental. Temporary Terminal Rental shall be measured and paid for on per Month basis and shall include installation of the trailer, all deck/ramps/walkways, and monthly expenses, and removal and restoration of the site at the end of the project.



95-02 Temporary Terminal Utility Hookups

The Contractor is responsible for temporary utility hookups (i.e. water, sanitary sewer, power, telephone, data/communication), as shown on sheet C-104. Once the New Terminal Building is ready for occupancy, Contractor shall remove the temporary utilities. Temporary Terminal Utility Hookups shall be measured and paid for on a lump sum basis and shall include all utilities, conduit, junction boxes, septic pump, etc. and connections and removal and restoration of the site at the end of the project.

95-03 Terminal Site Demolition

The existing terminal site demolition shall be performed as indicated in Specification Section 024116 Structure Demolition and includes demolition and removal of the existing terminal building, terminal foundation, AC unit and concrete pad, concrete sidewalk, drainage items, fencing, landscaping, utilities, and all other items as shown in the attached Plans not paid for under other items in Specification P-101. The Contractor is responsible for disposing of all materials and debris off Airport property in a properly permitted location. Terminal Site Demolition shall be measured and paid for on a lump sum basis.

95-04 Install New 1 1/2" Water Service and All Appurtenances contract pay item shall be based on the complete installation of the water service line, water meter, and back flow preventer to service the proposed Terminal Building. This item shall include but is not limited to: site preparation, location of underground utilities, all pipe materials, concrete for thrust blocking, trenching, excavation, pipe embedment, connection of the service line to the water main, backfill, material manipulation and dewatering. This item also includes topsoil stripping, stockpiling topsoil and final placement of topsoil; hauling, stockpiling and handling materials; excavation, rehandling, moisture-conditioning, placement, and compaction of earth materials excavation from the trench for backfill; off-site disposal of excess material; and coordination with Utility Company, the Airport and the Engineer.

Price bid shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to complete the item. The item shall be measured and paid for on a lump sum basis as indicated in the Specifications and as shown on Sheet C-601.

95-05 Install New 6" PVC Sanitary Sewer Service and All Appurtenances contract pay items shall be based on the complete installation of the sanitary sewer lateral with cleanouts to service the proposed Terminal Building. This item shall include but is not limited to: site preparation, location of underground utilities, all pipe materials, trenching, excavation, connection to the existing sewer manhole, pipe embedment, backfill, material manipulation and dewatering.

This item shall also include topsoil stripping, stockpiling topsoil and final

placement of topsoil; hauling, stockpiling and handling materials; excavation, rehandling, moisture-conditioning, placement, and compaction of earth materials excavation from the trench for backfill; off- site disposal of excess material; and coordination with Sewer Company, the Airport and the Engineer.

The project area shall be returned to a condition equal to or better than the pre-construction condition of the site.

The item shall be measured and paid for on a lump sum basis as indicated in the Specifications and as shown on Sheet C-601. Price bid shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to complete the item.

95-06 Terminal Site Electrical contract pay items shall be based on the complete installation of the electrical service to the proposed Terminal Building. This item shall include but is not limited to: site preparation, location of underground utilities, all pipe materials, trenching, excavation, relocation of existing electrical box, pipe embedment, backfill, and material manipulation and coordination with local electrical company, the Airport and the Engineer.

The item shall be measured and paid for on a lump sum basis as indicated in the Specifications and as shown on Sheet C-601. Price bid shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to complete the item.

95-07 Terminal Site Communications contract pay items shall be based on the complete installation of the telecommunications service to the proposed Terminal Building. This item shall include but is not limited to: site preparation, location of underground utilities, all pipe materials, trenching, excavation, relocation of existing telecommunications box, pipe embedment, backfill, and material manipulation and coordination with local telecommunications company, the Airport and the Engineer.

The item shall be measured and paid for on a lump sum basis as indicated in the Specifications and as shown on Sheet C-601. Price bid shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to complete the item.

95-08 Concrete Curb & Gutter

Concrete Curb & Gutter shall be measured and paid for on a per Linear Feet basis and shall include all labor, equipment, tools, and incidentals necessary to place concrete curb and gutter per the details shown on the plans at the locations indicated and details provided on the plans. Concrete utilized shall be in accordance with specification P-610.

95-9 5" Concrete Sidewalk

Concrete Sidewalk utilized on the project shall be in accordance with details shown on the plans. The Concrete Sidewalk shall be 5" thick and shall be measured and paid for on a per square yard basis and shall include all labor, equipment, tools, and incidentals necessary to place 5" concrete sidewalk at the locations indicated and details provided on the plans. Concrete utilized shall be in accordance with specification P-610.

95-10 Accessible Curb Ramp

Accessible Curb Ramp shall be constructed in accordance with the details shown on the project plans, including installation of detectable warning domes. Accessible Curb Ramp shall be measured and paid for on a per each basis and shall include all labor, equipment, tools, and incidentals necessary to place concrete curb ramp at the locations indicated and details provided on the plans including installation of detectable warning domes. Concrete utilized shall be in accordance with specification P-610.

95-11 Concrete Dumpster Pad

Concrete Dumpster Pad shall be constructed in accordance with the details shown on the project plans. Concrete dumpster pad shall be measured and paid for on a Lump Sum basis.

95-12 Paint Pavement Marking Lines, 4" (NCDOT Specification 1205)

This item shall include all pavement markings (lines). Markings shall be ready mixed type paint product conforming to Federal Specification TTP 1952F with spraying consistency suitable for use as a retroreflective pavement marking. Markings shall be applied in accordance with NCDOT standard Specification 1205. The per linear foot price shall be full compensation for all labor, equipment and materials needed to complete the work as depicted and detailed on the plans.

95-13 Handicap Parking Sign

Handicap Parking Signs shall be provided and installed in accordance with the details shown on the project plans. Handicap Parking Signs shall be measured and paid for on a per Each basis and shall include all labor, equipment, tools, and incidentals necessary to provide and install signs as indicated on the plans.

95-14 6" or 8" Schedule 40 PVC Pipe (Roof Drain)

Installation shall be in accordance with the project plans. The pipe shall be 6" or 8" Schedule 40 PVC pipe (as indicated in the plans) measured and paid for on a per linear foot basis. The unit price for the pipe shall include connection to the building roof leaders, connectors, bends, cleanouts, and all labor, materials and appurtenances necessary for the installation.

95-15 Landscaping

Landscaping shall include all landscaping shown and detailed on sheet C-900 and within Specification Section 32 90 00. The landscaping shall be paid for on

a lump sum basis. This shall include all landscaping and all labor, materials, and appurtenances necessary for the installation of the landscaping.

END OF SECTION 95

TEMP TCI
TEMPORARY CONSTRUCTION ITEMS

DESCRIPTION

TCI-1.1 **GENERAL.** This item consists of furnishing all labor, materials and equipment for temporary construction items necessary for the safe and proper execution of construction and not otherwise included in other Contract items. The Contractor will be expected to supply and utilize the items listed below and other items as required in the Construction Notes or as contained in the drawings and technical specifications. Temporary construction items include, but are not limited to providing and maintaining construction fencing, portable floodlighting, steel plates, temporary haul road construction/maintenance, maintenance of traffic, flaggers, safety personnel, personnel training, temporary sanitary facilities, temporary drainage, temporary generator(s), waste disposal facilities, reworked/temporary materials, men and equipment as needed to keep all aircraft and/or vehicle traffic areas free of debris and ongoing construction activities.

MATERIALS

TCI-2.1 **LIGHTED BARRICADES**. Construction barricades shall be High Density Polyethylene (HDPE) water-ballast barricades and shall be constructed in accordance with the detail shown on plan sheet C-101. Lighted barricades shall be placed in accordance with the Construction Safety and Phasing Plans and around all cranes, equipment, and staging areas on the paved areas.

TCI-2.2 **CONSTRUCTION FENCING AND GATES**. Construction fencing shall be per detail shown on plan sheet C-102 or shall be 8’ high chainlink fence with 3 strands or barbed wire. Construction fencing shall be placed in accordance with the Construction Safety and Phasing Plans.

TCI-2.3 **PORTABLE FLOODLIGHTING**. Portable floodlighting shall be provided, as required, for construction operations during nighttime work. The Contractor shall provide sufficient units so that all work areas are illuminated to a level of 5 horizontal footcandles. The lighting levels shall be calculated and measured in accordance with the current standards of the Illumination Engineering Society.

TCI-2.4 **STEEL PLATES**. Steel plates or similar protective material of adequate size and thickness shall be furnished as necessary to cover temporary excavations, unfinished structures or surfaces requiring protection or for safety purposes. Plates shall be securely fastened down and shall be adequate to safely support any anticipated loadings to be imposed.

TCI-2.5 **TEMPORARY HAUL ROAD CONSTRUCTION/MAINTENANCE**. Contractor haul routes have been designated on the Plans and it shall be the Contractor's responsibility to construct. It shall be the Contractor's responsibility to inspect the existing conditions of the haul road prior to construction. Contractor shall construct the haul route(s) in accordance with the details provided on the plans. During construction, the Contractor shall be responsible for maintaining and repairing the haul road as required or directed by the Engineer. Locations of haul roads shall be restored to their original conditions at the conclusion of construction activities.

TCI-2.6 **MAINTENANCE OF TRAFFIC**. Additional items required for temporary traffic control around the airport's roadways include temporary signs, variable message signs, flashing arrow boards, lighting and warning devices, temporary pavement markings, channelizing devices, concrete barriers, crash cushions, barrels, and cones. All temporary traffic control devices shall be in accordance with NCDOT and local standards. Temporary signs shall also be in accordance with the contract documents.

TCI-2.7 **TEMPORARY DRAINAGE**. Items required for temporary drainage include, but are not limited to HDPE pipe, end sections, and grading of swales as required for maintenance of existing drainage patterns. Temporary drainage pipe shall be in accordance with Specification Section D-701, Pipe for Storm Drains and Culverts.

TCI-2.8 **WASTE DISPOSAL FACILITIES**. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

CONSTRUCTION METHODS

TCI-3.1 **CONSTRUCTION FENCING AND GATES**. Construction fencing and gates shall be placed in accordance with the construction plans and as needed and shall remain in place or moved as directed until completion of work in each phase or area. The Contractor shall be responsible for maintaining the fence in good working condition throughout the duration of the contract.

TCI-3.2 **PORTABLE FLOODLIGHTING**. Portable floodlighting is required for construction during periods of limited visibility (i.e., nighttime). Illumination requirements shall be those contained in Paragraph 2.2. Portable floodlighting shall not penetrate any operational surfaces. Floodlighting shall be directed to avoid interference with Air Traffic Controllers or aircraft pilots. Hoods or shields may be required to prevent interference. See additional requirements on the plans.

TCI-3.3 **MAINTENANCE OF TRAFFIC**. Temporary traffic control shall be in accordance with NCDOT and local standards.

TCI-3.4 **CONSTRUCTION MATERIALS STOCKPILING AND EQUIPMENT STORAGE.** Stockpiling of construction materials and equipment storage is not permitted within operating taxiway object free areas. Stockpiled material must be protected against jet blast. Stockpiled materials and equipment should be prominently marked and lighted during hours of restricted visibility or darkness if in the air operations area. Stockpiled material or equipment should not be stored near aircraft turning areas or operational movement areas, aprons, or excavations and trenches. The stockpiled construction materials and equipment shall not cause degraded or hazardous conditions to Airport operations safety. This includes determining and verifying that stockpiled materials and equipment are stored or parked at an approved location, that they are properly stowed to prevent foreign object debris (FOD), attraction by wildlife, or obstruction of air operations either by their proximity to NAVAIDs or to aircraft movement areas.

TCI-3.5 **FOREIGN OBJECT DEBRIS (FOD) MANAGEMENT**. Waste and loose materials capable of causing damage to aircraft landing gear or propellers or capable of being ingested in jet engines should not be left or placed on or near active aircraft movement areas. Materials tracked onto these areas shall be continuously removed by the Contractor during the construction project. Waste or loose materials that could attract wildlife shall be carefully controlled and removed on a continuous basis. The Contractor shall have sufficient mechanized sweepers and covered trash containers on site to comply with this requirement at all times. The construction area shall be kept clean at all times of debris that may blow onto the airfield.

TCI-3.6 **FLAGGERS.** Not Required.

TCI-3.7 **TEMPORARY DRAINAGE**. Temporary drainage items shall be provided and installed in accordance with the plans and/or as needed to meet project phasing, drainage, and erosion and sediment control requirements. Drainage measures shall be placed in a manner that will provide for maintenance of existing drainage patterns to the maximum extent possible. Construction methods for installation shall be in accordance with Specification Section D-701, Pipe for Storm Drains and Culverts, and Specification Section D-752, Concrete Culverts, Headwalls, and Miscellaneous Drainage Structures.

METHOD OF MEASUREMENT

TCI-4.1 Temporary Construction Items: No direct measurement will be made for this item as payment will be made on a lump sum basis.

BASIS OF PAYMENT

TCI-5.1 TEMPORARY CONSTRUCTION ITEMS. Payment will be made at the lump sum bid price for "Temporary Construction Items." This payment shall be full compensation for furnishing all materials and labor for placing, moving and removing lighted barricades, construction fencing and gates; furnishing portable floodlighting; maintenance of traffic; and for any other labor, materials, equipment, tools and incidentals necessary for temporary items required for construction of this project.

Payment for this item will be made in installments. The first payment of 10 percent of the lump sum price will be included in the payment following the construction notice to proceed (CNTP). The remaining 90 percent of the lump sum price will be included as installments in subsequent pay requests. Each such installment will be determined based on the ratio of the total work completed to date to the total contract amount.

Payment will be made under:

Item PCI-5.1-1 Temporary Construction Items – per Lump Sum

END OF ITEM PCI

ITEM C-102

TEMPORARY AIR AND WATER POLLUTION, SOIL EROSION, AND SILTATION CONTROL

DESCRIPTION

102-1 This item shall consist of temporary control measures as shown on the plans or as ordered by the ENGINEER during the life of a contract to control pollution of air and water, soil erosion, and siltation through the use of silt fences, berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

Temporary erosion control shall be in accordance with the approved erosion control plan; the approved Construction Safety and Phasing Plan (CSPP) and AC 150/5370-2G, *Operational Safety on Airports During Construction*. The temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

Temporary control measures shall be designed, installed, and maintained to minimize the creation of wildlife attractants that have the potential to attract hazardous wildlife on or near public-use airports.

MATERIALS

102-2.1 Grass. Grass that will not compete with the grasses sown later for permanent cover per Item T-901 shall be a quick-growing species (such as ryegrass, Italian ryegrass, or cereal grasses) suitable to the area providing a temporary cover. Selected grass species shall not create a wildlife attractant.

102-2.2 Mulches. Mulches may be hay, straw, fiber mats, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials per Item T-908. Mulches shall not create a wildlife attractant.

102-2.3 Fertilizer. Fertilizer shall be a standard commercial grade in accordance with Item T-901 and shall conform to all federal and state regulations and to the standards of the Association of Official Agricultural Chemists.

102-2.4 Slope Drains. Not Used.

102-2.5 Silt Fence. Silt fence shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life. Silt fence shall meet the requirements of ASTM D6461.

102-2.6 Other. All other materials shall meet commercial grade standards and shall be approved by the ENGINEER before being incorporated into the project.

CONSTRUCTION REQUIREMENTS

102-3.1 General. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.

The ENGINEER shall be responsible for assuring compliance to the extent that construction practices, construction operations, and construction work are involved.

102-3.2 Schedule. Prior to the start of construction, the Contractor shall submit schedules in accordance with the approved Construction Safety and Phasing Plan (CSPP) and the plans for accomplishment of temporary and permanent erosion control work for clearing and grubbing; grading; construction; paving; and structures at watercourses. The Contractor shall also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work shall not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the ENGINEER.

102-3.3 Construction Details. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the plans and approved CSPP. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages as soon as substantial areas of exposed slopes can be made available. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

Where erosion may be a problem, schedule and perform clearing and grubbing operations so that grading operations and permanent erosion control features

can follow immediately if project conditions permit. Temporary erosion control measures are required if permanent measures cannot immediately follow grading operations. The ENGINEER shall limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current with the accepted schedule. If seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified as directed by the ENGINEER.

The Contractor shall provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment as directed by the ENGINEER. If temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or directed by the ENGINEER, the work shall be performed by the Contractor and the cost shall be incidental to this item.

The ENGINEER may increase or decrease the area of erodible earth material that can be exposed at any time based on an analysis of project conditions.

The erosion control features installed by the Contractor shall be maintained by the Contractor during the construction period.

Provide temporary structures whenever construction equipment must cross watercourses at frequent intervals. Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into any waterways, impoundments or into natural or manmade channels.

102-3.4 Installation, Maintenance and Removal of Silt Fence. Silt fences shall extend a minimum of 16 inches and a maximum of 34 inches above the ground surface. Posts shall be set no more than 10 feet on center. Filter fabric shall be cut from a continuous roll to the length required minimizing joints where possible. When joints are necessary, the fabric shall be spliced at a support post with a minimum 12-inch overlap and securely sealed. A trench shall be excavated approximately 4 inches deep by 4 inches wide on the upslope side of the silt fence. The trench shall be backfilled, and the soil compacted over the silt fence fabric. The Contractor shall remove and dispose of silt that accumulates during construction and prior to establishment of permanent erosion control. The fence shall be maintained in good working condition until permanent erosion control is established. Silt fence shall be removed upon approval of the ENGINEER.

METHOD OF MEASUREMENT

102-4.1 Temporary erosion and pollution control work required will be performed as scheduled or directed by the ENGINEER. Completed and accepted work will be measured as follows:

A. Temporary Construction Entrance will be measured per each.

B. Installation and Removal of Silt Fence will be measured by the linear foot.

C. Temporary Drop Inlet Protection will be measured per each.

D. Temporary Rock Pipe Inlet Protection will be measured per each.

E. Dewatering Structure/Bag will be measured per each.

F. Temporary Seeding and Mulching will be measured by the acre

G. Rip Rap Outlet Protection will be measured per the square yard

H. Concrete Washout Structure will be measure per each

102-4.2 Control work performed for protection of construction areas outside the construction limits, such as borrow and waste areas, haul roads, equipment and material storage sites, and temporary plant sites, will not be measured and paid for directly but shall be considered as a subsidiary obligation of the Contractor.

BASIS OF PAYMENT

102-5.1 Accepted quantities of temporary water pollution, soil erosion, and siltation control work ordered by the ENGINEER and measured as provided in Paragraph 102-4.1 will be paid for under:

Item C-102-5.1 Temporary Construction Entrance – per Each

Item C-102-5.2 Installation and Removal of Silt Fence - per Linear Feet

Item C-102-5.3 Temporary Drop Inlet Protection – per Each

Item C-102-5.4 Temporary Rock Pipe Inlet Protection – per Each

Item C-102-5.5 Dewatering Structure/Bag – per Each

Item C-102-5.6 Temporary Seeding and Mulching - per Acre

Item C-102-5.7 Rip Rap Outlet Protection – per Square Yard

Item C-102-5.8 Concrete Washout Structure – per Each

Where other directed work falls within the specifications for a work item that has a contract price, the units of work shall be measured and paid for at the contract unit price bid for the various items.

Temporary control features not covered by contract items that are ordered by the ENGINEER will be paid for in accordance with Section 90, Paragraph 90-05 *Payment for Extra Work*.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Advisory Circulars (AC)

AC 150/5200-33C *Hazardous Wildlife Attractants on or Near Airports*

AC 150/5370-2G *Operational Safety on Airports During Construction*

ASTM International (ASTM)

ASTM D6461 *Standard Specification for Silt Fence Materials*

United States Department of Agriculture (USDA)

FAA/USDA Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM C-102

ITEM C-105

MOBILIZATION

105-1 Description. This item of work shall consist of, but is not limited to, work and operations necessary for the movement of personnel, equipment, material and supplies to and from the project site for work on the project except as provided in the contract as separate pay items.

105-2 Mobilization Limit. Mobilization shall be limited to 10 percent of the total project cost.

105-3 Posted Notices. Prior to commencement of construction activities, the Contractor must post the following documents in a prominent and accessible place where they may be easily viewed by all employees of the prime Contractor and by all employees of subcontractors engaged by the prime Contractor: Equal Employment Opportunity (EEO) Poster "Equal Employment Opportunity is the Law" in accordance with the Office of Federal Contract Compliance Programs Executive Order 11246, as amended; Davis Bacon Wage Poster (WH 1321) - DOL "Notice to All Employees" Poster; and Applicable Davis-Bacon Wage Rate Determination. These notices must remain posted until final acceptance of the work by the Owner.

105-4 Engineer's/RPR Field Office. An ENGINEER's/RPR field office is not required.

METHOD OF MEASUREMENT AND PAYMENT

105-5.1 Mobilization. Based upon the contract lump sum price for "Mobilization" partial payments will be allowed as follows:

A. With first pay request, 25%.

B. When 25% or more of the original contract is earned, an additional 25%.

C. When 50% or more of the original contract is earned, an additional 40%.

D. After Final Inspection, Staging area clean-up and delivery of all Project Closeout materials as required by Section 90, Paragraph 90-11, *Contractor Final Project Documentation,* the final 10%.

BASIS OF PAYMENT

105-6 Payment will be Made Under:

Item C-105.6.1 Mobilization - per Lump Sum

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Office of Federal Contract Compliance Programs (OFCCP)

Executive Order 11246 (As Amended)

EEOC-P/E-1 Equal Employment Opportunity is the Law Poster

United States Department of Labor, Wage and Hour Division (WHD)

WH 1321 Employee Rights under the Davis-Bacon Act Poster

END OF ITEM C-105

ITEM P-101

PREPARATION/REMOVAL OF EXISTING PAVEMENTS AND MISCELLAEOUS ITEMS

DESCRIPTION

101-1 This item shall consist of preparation of existing pavement surfaces for overlay, surface treatments, removal of existing pavement, and other miscellaneous items. The work shall be accomplished in accordance with these specifications and the applicable plans.

EQUIPMENT AND MATERIALS

101-2 All equipment and materials shall be specified here and in the following paragraphs or approved by the ENGINEER. The equipment shall not cause damage to the pavement to remain in place.

CONSTRUCTION

101-3.1 Removal of Existing Pavement.
The Contractor's removal operation shall be controlled to not damage adjacent pavement structure, and base material, cables, utility ducts, pipelines, or drainage structures which are to remain under the pavement.

A. Concrete Pavement Removal. Not Used

B. Asphalt Pavement Removal. Asphalt pavement to be removed shall be cut to the full depth of the asphalt pavement around the perimeter of the area to be removed. Pavement removal shall be full depth including any base course to soil subgrade.

C. Repair or Removal of Base, Subbase, and/or Subgrade. Not Used.

101-3.2 Preparation of Joints and Cracks Prior to Overlay/Surface Treatment. Not Used.

101-3.3 Removal of Foreign Substances/Contaminates Prior to (Overlay) (Sealcoat) (Remarking) Not Used.

101-3.4 Concrete Spall or Failed Asphaltic Concrete Pavement Repair.

A. Repair of Concrete Spalls in Areas to be Overlaid with Asphalt. Not Used.

B. Asphalt Pavement Repair. Not Used.

101-3.5 Cold Milling. Milling shall be performed with a power-operated milling machine or grinder, capable of producing a uniform finished surface. The milling machine or grinder shall operate without tearing or gouging the underlaying surface. The milling machine or grinder shall be equipped with grade and slope controls, and a positive means of dust control. All millings shall be removed and disposed of off Airport property. If the Contractor mills or grinds deeper or wider than the plans specify, the Contractor shall replace the material removed with new material at the Contractor's Expense.

A. Patching. The milling machine shall be capable of cutting a vertical edge without chipping or spalling the edges of the remaining pavement and it shall have a positive method of controlling the depth of cut. The Contractor shall layout the area to be milled with a straightedge in increments of 1-foot widths. The area to be milled shall cover only the failed area. Any excessive area that is milled because the Contractor does not have the appropriate milling machine, or areas that are damaged because of his negligence, shall be repaired by the Contractor at the Contractor's Expense.

B. Profiling, Grade Correction, or Surface Correction. The milling machine shall have a minimum width of 7 feet, and it shall be equipped with electronic grade control devices that will cut the surface to the grade specified. The tolerances shall be maintained within +0 inch and -1/4 inch of the specified grade. The machine must cut vertical edges and have a positive method of dust control. The machine must have the ability to remove the millings or cuttings from the pavement and load them into a truck. All millings shall be removed and disposed of off the Airport.

C. Clean-Up. The Contractor shall sweep the milled surface daily and immediately after the milling until all residual materials are removed from the pavement surface. Prior to paving, the Contractor shall wet down the milled pavement and thoroughly sweep and/or blow off the surface to remove loose residual material. Waste materials shall be collected and removed from the pavement surface and adjacent areas by sweeping or vacuuming. Waste materials shall be removed and disposed of off Airport.

101-3.6. Preparation of Asphalt Pavement Surfaces Prior to Surface Treatment. Not Used.

101-3.7 Maintenance. The Contractor shall perform all maintenance work necessary to keep the pavement in a satisfactory condition until the full section is complete and accepted by the ENGINEER. The surface shall be kept clean and free from foreign material. The pavement shall be properly drained at all times. If cleaning is necessary or if the pavement becomes disturbed, any work repairs necessary shall be performed at the Contractor's expense.

101-3.8 Preparation of Joints in Rigid Pavement Prior to Resealing. Not Used.

101-3.8.1 Removal of Existing Joint Sealant. Not Used.

101-3.8.2 Cleaning Prior to Sealing. Not Used.

101-3.8.3 Joint Sealant. Not Used.

101-3.9 Preparation of Cracks in Flexible Pavement Prior to Sealing. Not Used.

101-3.9.1 Preparation of Crack. Not Used.

101-3.9.2 Removal of Existing Crack Sealant. Not Used.

101-3.9.3 Crack Sealant. Not Used.

101-3.9.4 Removal of Pipe and other Buried Structures. Not Used.

METHOD OF MEASUREMENT

101-4.1 General. See Specification C-95 for Item "Terminal Site Demolition" for all other removal work not covered under this specification.

101-4.1 Removal of Existing Asphalt Pavement. The unit of measurement for pavement removal shall be the number of square yards removed by the Contractor. Any pavement removed outside the limits of removal because the pavement was damaged by negligence on the part of the Contractor shall not be included in the measurement for payment. No direct measurement or payment shall be made for saw cutting. Saw cutting shall be incidental to pavement removal. Dowel bar installation shall be incidental to pavement removal.

101-4.3 Milling Existing Asphalt Pavement. The unit of measure for milling shall be per square yard. The location and average depth of the milling shall be as

shown on the plans. If the initial cut does not meet the depth required, the Contractor shall re-mill the area and will be paid only for the area once.

BASIS OF PAYMENT

101-5.1 Payment. Payment shall be made at contract unit price for the unit of measurement as specified above. This price shall be full compensation for furnishing all materials and for all preparation, hauling, and placing of the material and for all labor, equipment, tools, and incidentals necessary to complete this item.

Item P-101-5.1 Removal of Existing Asphalt Pavement - per Square Yard

Item P-101-5.2 Milling Existing Asphalt Pavement – per Square Yard

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Advisory Circulars (AC)

AC 150/5380-6C Guidelines and Procedures for Maintenance of Airport Pavements.

ASTM International (ASTM)

ASTM D6690 Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

END OF ITEM P-101

ITEM P-152

EXCAVATION, SUBGRADE, AND EMBANKMENT

DESCRIPTION

152-1.1 This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct areas for drainage, building construction, parking, or other purposes in accordance with these specifications and in conformity to the dimensions and typical sections shown on the plans.

152-1.2 Classification. All material excavated shall be classified as defined below:

A. Unclassified Excavation. Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature which is not otherwise classified and paid for under one of the following items.

B. Undercut Excavation. Undercut excavation shall consist of the removal and disposal of deposits or mixtures of soils and organic matter not suitable for foundation material. Undercut Excavation shall include materials that will decay or produce subsidence in the embankment. It may consist of decaying stumps, roots, logs, humus, or other material not satisfactory for incorporation in the embankment. This item shall also include replacement of the excavated unsuitable material with suitable material from off-site excavation sources consisting of material classification of SP, SC, SM, ML, or CL as defined by USCS with a CBR of 10. The Engineer shall concur in the limits of unsuitable materials for all areas of undercut excavation prior to beginning excavation.

C. Borrow Embankment. Borrow Embankment shall consist of approved material required for the construction of embankments or for other portions of the work in excess of the quantity of usable material available from required excavations. Borrow material shall be obtained from areas outside the airport boundaries consisting of material classification of SP, SC, SM, ML, or CL as defined by USCS with a CBR of 10.

D. Terminal Site Grading. Terminal Site Grading shall consist of any grading operations (excavation or borrow embankment) required within the area as indicated on the plans for “Terminal Site Grading”.

152-1.3 Unsuitable Excavation. Unsuitable material shall be disposed in designated waste areas as shown on the plans. Materials containing vegetable or organic matter, such as muck, peat, organic silt, or sod shall be considered unsuitable

for use in embankment construction. Material suitable for topsoil may be used on the embankment slope when approved by the ENGINEER.

CONSTRUCTION METHODS

152-2.1 General. Before beginning excavation, grading, and embankment operations in any area, the area shall be cleared or cleared and grubbed as necessary.

The suitability of material to be placed in embankments shall be subject to approval by the ENGINEER. All unsuitable material shall be disposed of in waste areas as shown on the plans. All waste areas shall be graded to allow positive drainage of the area and adjacent areas. The surface elevation of waste areas shall be specified on the plans or approved by the ENGINEER.

When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued and the ENGINEER notified per Section 70, Paragraph 70-20. At the direction of the ENGINEER, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

Areas outside the limits of the pavement areas where the top layer of soil has become compacted by hauling or other Contractor activities shall be scarified and disked to a depth of 4 inches, to loosen and pulverize the soil. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in the top 6 inches of the subgrade.

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor shall notify the ENGINEER, who shall arrange for their removal if necessary. The Contractor, at their own expense, shall satisfactorily repair or pay the cost of all damage to such facilities or structures that may result from any of the Contractor's operations during the period of the contract.

A. Blasting. Blasting shall not be allowed.

152-2.2 Excavation. No excavation shall be started until the work has been staked out by the Contractor and the ENGINEER has obtained from the Contractor, the survey notes of the elevations and measurements of the ground surface. The Contractor and ENGINEER shall agree that the original ground lines shown on the original topographic mapping are accurate or agree to any adjustments made to the original ground lines.

Digital terrain model (DTM) files of the existing surfaces finished surfaces and other various surfaces were used to develop the design plans.

Volumetric quantities were calculated by comparing DTM files of the applicable design surfaces and generating Triangle Volume Reports. Electronic copies of DTM files and a paper copy of the original topographic map will be issued to the successful bidder.

Existing grades on the design cross sections or DTM's, where they do not match the locations of actual spot elevations shown on the topographic map, were developed by computer interpolation from those spot elevations. Prior to disturbing original grade, Contractor shall verify the accuracy of the existing ground surface by verifying spot elevations at the same locations where original field survey data was obtained as indicated on the topographic map. Contractor shall recognize that, due to the interpolation process, the actual ground surface at any particular location may differ somewhat from the interpolated surface shown on the design cross sections or obtained from the DTM's. Contractor's verification of original ground surface, however, shall be limited to verification of spot elevations as indicated herein, and no adjustments will be made to the original ground surface unless the Contractor demonstrates that spot elevations shown are incorrect. For this purpose, spot elevations which are within 0.1 foot of the stated elevations for ground surfaces, or within 0.04 foot for hard surfaces (pavements, buildings, foundations, structures, etc.) shall be considered "no change". Only deviations in excess of these will be considered for adjustment of the original ground surface. If Contractor's verification identifies discrepancies in the topographic map, Contractor shall notify the ENGINEER in writing at least two weeks before disturbance of existing grade to allow sufficient time to verify the submitted information and make adjustments to the design cross sections or DTM's. Disturbance of existing grade in any area shall constitute acceptance by the Contractor of the accuracy of the original elevations shown on the topographic map for that area.

All areas to be excavated shall be stripped of vegetation and topsoil. Topsoil shall be stockpiled for future use in areas designated on the plans or by the ENGINEER. All suitable excavated material shall be used in the formation of embankment, subgrade, or other purposes as shown on the plans. All unsuitable material shall be disposed of as shown on the plans.

The grade shall be maintained so that the surface is well drained at all times.

When the volume of the excavation exceeds that required to construct the embankments to the grades as indicated on the plans, the excess shall be used to grade the areas of ultimate development or disposed as directed by the ENGINEER. When the volume of excavation is not sufficient for constructing

the embankments to the grades indicated, the deficiency shall be obtained from borrow areas.

A. Selective Grading. When selective grading is indicated on the plans, the more suitable material designated by the ENGINEER shall be used in constructing the embankment or in capping the pavement subgrade. If, at the time of excavation, it is not possible to place this material in its final location, it shall be stockpiled in approved areas until it can be placed. The more suitable material shall then be placed and compacted as specified. Selective grading shall be considered incidental to the work involved. The cost of stockpiling and placing the material shall be included in the various pay items of work involved.

B. Undercutting. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turf shall be excavated to a minimum depth of 12 inches below the subgrade or to the depth specified by the ENGINEER. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed of off the Airport. The cost is incidental to this item. This excavated material shall be paid for at the contract unit price per cubic yard for Undercut Excavation. The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary backfill will constitute a part of the embankment. Where rock cuts are made, backfill with select material. Any pockets created in the rock surface shall be drained in accordance with the details shown on the plans. Undercutting will be paid as Undercut Excavation.

C. Over-Break. Over-break, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the ENGINEER. All over-break shall be graded or removed by the Contractor and disposed of as directed by the ENGINEER. The ENGINEER shall determine if the displacement of such material was unavoidable and their own decision shall be final. Payment will not be made for the removal and disposal of over-break that the ENGINEER determines as avoidable. Unavoidable over-break will be classified as “Unclassified Excavation.”

D. Removal of Utilities. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by the Contractor as indicated on the plans. All existing foundations shall be excavated at least 2 feet below the top of subgrade or as indicated on the plans, and the material disposed of as directed by the ENGINEER. All foundations thus excavated shall be backfilled with suitable material and compacted as specified for embankment or as shown on the plans.

152-2.3 Borrow Excavation. There are no borrow sources within the boundaries of the Airport property. The Contractor shall locate and obtain borrow sources, subject to the approval of the ENGINEER. The Contractor shall notify the ENGINEER at least 15 days prior to beginning the excavation so necessary measurements and tests can be made by the ENGINEER. All borrow pits shall be opened to expose the various strata of acceptable material to allow obtaining a uniform product. Borrow areas shall be drained and left in a neat, presentable condition with all slopes dressed uniformly. Borrow areas shall not create a hazardous wildlife attractant.

152-2.4 Drainage Excavation. Not Used.

152-2.5 Preparation of Cut Areas or Areas Where Existing Pavement Has Been Removed. In those areas on which a subbase or base course is to be placed, the top 12 inches of subgrade shall be compacted to not less than 98% of maximum dry density as determined by ASTM D698.

152-2.6 Preparation of Embankment Area. All sod and vegetative matter shall be removed from the surface upon which the embankment is to be placed. The cleared surface shall be broken up by plowing or scarifying to a minimum depth of 6 inches and shall then be compacted per Paragraph 152-2.10.

Sloped surfaces steeper than one (1) vertical to four (4) horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill.

No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

152-2.7 Control Strip. The first half-day of construction of subgrade and/or embankment shall be considered as a control strip for the Contractor to demonstrate, in the presence of the RPR/ENGINEER, that the materials, equipment, and construction processes meet the requirements of this specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR/ENGINEER must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted, or removed and replaced at the Contractor's expense. Full operations shall not begin until the control strip has been accepted by the ENGINEER. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved in advance by the ENGINEER.

152-2.8 Formation of Embankments. The material shall be constructed in lifts as established in the control strip, but not less than 6 inches nor more than 12 inches of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications.

The lifts shall be placed, to produce a soil structure as shown on the typical cross-section or as directed by the ENGINEER. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained due to rain, freezing, or other unsatisfactory weather conditions in the field. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. The Contractor shall drag, blade, or slope the embankment to provide surface drainage at all times.

The material in each lift shall be within ±2% of optimum moisture content before rolling to obtain the prescribed compaction. The material shall be moistened or aerated as necessary to achieve a uniform moisture content throughout the lift. Natural drying may be accelerated by blending in dry material or manipulation alone to increase the rate of evaporation.

The Contractor shall make the necessary corrections and adjustments in methods, materials, or moisture content to achieve the specified embankment density.

The ENGINEER will take samples of excavated materials which will be used in embankment for testing and develop a Moisture-Density Relations of Soils Report (Proctor) in accordance with ASTM D698. A new Proctor shall be developed for each soil type based on visual classification.

Density tests will be taken by the ENGINEER for every 1,000 square yards of compacted embankment for each lift which is required to be compacted, or other appropriate frequencies as determined by the ENGINEER.

If the material has greater than 30% retained on the 3/4-inch sieve, follow AASHTO T-180 Annex Correction of maximum dry density and optimum moisture for oversized particles.

Rolling operations shall be continued until the embankment is compacted to not less than 95% of maximum density as determined by ASTM D698. Under all areas to be paved, the embankments shall be compacted to a depth of 12 inches below pavement subgrade to a density of not less than 98% percent of the maximum density as determined by ASTM D698.

On all areas outside of the pavement areas, no compaction will be required on the top 4 inches which shall be prepared for a seedbed in accordance with Item T-901.

The in-place field density shall be determined in accordance with ASTM D1556 or ASTM 6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. The ENGINEER shall perform all density tests. If the specified density is not attained, the area represented by the test or as designated by the ENGINEER shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

Compaction areas shall be kept separate, and no lift shall be covered by another lift until the proper density is obtained.

During construction of the embankment, the Contractor shall route all construction equipment evenly over the entire width of the embankment as each lift is placed. Lift placement shall begin in the deepest portion of the embankment fill. As placement progresses, the lifts shall be constructed approximately parallel to the finished pavement grade line.

When rock, concrete pavement, asphalt pavement, and other embankment material are excavated at approximately the same time as the subgrade, the material shall be incorporated into the outer portion of the embankment and the subgrade material shall be incorporated under the future paved areas. Stones, fragmentary rock, and recycled pavement larger than 4 inches in their greatest dimensions will not be allowed in the top 12 inches of the subgrade. Rockfill shall be brought up in lifts as specified or as directed by the ENGINEER and the finer material shall be used to fill the voids forming a dense, compact mass. Rock, cement concrete pavement, asphalt pavement, and other embankment

material shall not be disposed of except at places and in the manner designated on the plans or by the ENGINEER.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in lifts of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment as directed in lifts not exceeding 2 feet in thickness. Each lift shall be leveled and smoothed with suitable equipment by distribution of spalls and finer fragments of rock. The lift shall not be constructed above an elevation 4 feet below the finished subgrade.

There will be no separate measurement of payment for compacted embankment. All costs incidental to placing in lifts, compacting, discing, watering, mixing, sloping, and other operations necessary for construction of embankments will be included in the contract price for excavation, borrow, or other items.

152-2.9 Proof Rolling. The purpose of proof rolling the subgrade is to identify any weak areas in the subgrade and not for compaction of the subgrade. Before start of embankment, and after compaction is completed, the subgrade area shall be proof rolled with a loaded tandem axle dump truck in the presence of the RPR/ENGINEER. Apply a minimum of two coverages, or as specified by the ENGINEER, under pavement areas. A coverage is defined as the application of one tire print over the designated area. Soft areas of subgrade that deflect more than 1 inch or show permanent deformation greater than 1 inch shall be removed and replaced with suitable material or reworked to conform to the moisture content and compaction requirements in accordance with these specifications. Removal and replacement of soft areas is incidental to this item.

152-2.10 Compaction Requirements. The subgrade under areas to be paved shall be compacted to a depth of 12 inches and to a density of not less than 98 percent of the maximum dry density as determined by ASTM D698. The subgrade in areas outside the limits of the pavement areas shall be compacted to a depth of 12 inches and to a density of not less than 95 percent of the maximum density as determined by ASTM D698.

The material to be compacted shall be within ±2% of optimum moisture content before being rolled to obtain the prescribed compaction (except for expansive soils). Compaction moisture should be maintained very near optimum moisture content in the final 2 to 3 feet below pavement subgrade to assist in achieving stability at subgrade elevation. When the material has greater than 30 percent retained on the ¾ inch sieve, follow the methods in ASTM D698. Tests for moisture content and compaction will be taken at a minimum of 2,000 S.Y. of

subgrade. All quality assurance testing shall be done by the ENGINEER for acceptance determination.

The in-place field density shall be determined in accordance with ASTM D1556 or ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938 within 12 months prior to its use on this contract. The gage shall be field standardized daily.

Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

If the specified density is not attained, the entire lot shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

All cut-and-fill slopes shall be uniformly dressed to the slope, cross-section, and alignment shown on the plans or as directed by the ENGINEER and the finished subgrade shall be maintained.

152-2.11 Finishing and Protection of Subgrade. Finishing and protection of the subgrade is incidental to this item. Grading and compacting of the subgrade shall be performed so that it will drain readily. All low areas, holes or depressions in the subgrade shall be brought to grade. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans. All ruts or rough places that develop in the completed subgrade shall be graded, re-compacted, and retested. The Contractor shall protect the subgrade from damage and limit hauling over the finished subgrade to only traffic essential for construction purposes.

The Contractor shall maintain the completed course in satisfactory condition throughout placement of subsequent layers. No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been accepted by the ENGINEER.

152-2.12 Haul. All hauling will be considered a necessary and incidental part of the work. The Contractor shall include the cost in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

The Contractor's equipment shall not cause damage to any excavated surface, compacted lift or to the subgrade as a result of hauling operations. Any damage

caused as a result of the Contractor's hauling operations shall be repaired at the Contractor's expense.

The Contractor shall be responsible for providing, maintaining, and removing any haul roads or routes within or outside of the work area, and shall return the affected areas to their former condition, unless otherwise authorized in writing by the Owner. No separate payment will be made for any work or materials associated with providing, maintaining, and removing haul roads or routes.

152-2.13 Surface Tolerances. In those areas on which a subbase or base course is to be placed, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and re-compacted to grade until the required smoothness and accuracy are provided to and approved by the ENGINEER. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR/ENGINEER. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

A. Smoothness. The finished surface shall not vary more than +/- ½ inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

B. Grade. The grade and crown shall be measured on a 50-foot grid and shall be within +/-0.05 feet of the specified grade.

On safety areas, turfed areas, and other designated areas within the grading limits where no subbase or base is to be placed, grade shall not vary more than 0.10 feet from specified grade. Any deviation in excess of this amount shall be corrected by loosening, adding, or removing materials, and reshaping.

152-2.14 Topsoil. When topsoil is specified or required as shown on the plans, it shall be salvaged from stripping or other grading operations. If, at the time of excavation or stripping, the topsoil cannot be placed in its final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall be located as shown on the plans and the approved CSPP and shall not be placed on areas that subsequently will require any excavation or embankment fill. If, in the judgment of the ENGINEER, it is practical to place the salvaged topsoil at the time of excavation or stripping, the material shall be placed in its final position without stockpiling or further re-handling.

Upon completion of grading operations, stockpiled topsoil shall be handled and placed as shown on the plans. No direct payment will be made for topsoil.

METHOD OF MEASUREMENT

152-3.1 The quantity of unclassified excavation to be paid for shall be the number of cubic yards measured in its original position. Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed.

152-3.2 The quantity of undercut excavation to be paid for shall be the number of cubic yards excavated including backfilling with as determined by direct measurement of length, width, and depth of excavation measured in its original position.

152-3.3 The quantity of borrow embankment to be paid for shall be the number of cubic yards measured in its final position. Measurement shall not include the quantity of material used for purposes other than those directed.

152-3.4 The quantity of Terminal Site Grading to be paid for shall be per lump sum.

BASIS OF PAYMENT

152-4.1 Unclassified excavation payment shall be made at the contract unit price per cubic yard. This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.2 Undercut Excavation payment shall be made at the contract unit price per cubic yard. This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.3 Borrow Embankment payment shall be made at the contract unit price per cubic yard. This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

152-4.4 Terminal Site Grading payment shall be made at the contract unit price per lump sum. This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-152-4.1 Unclassified Excavation – per cubic yard

Item P-152-4.2 Undercut Excavation – per cubic yard

Item P-152-4.3 Borrow Embankment – per cubic yard

Item P-152-4.4 Terminal Site Grading – per lump sum

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO T-180	Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18-in. Drop

ASTM International (ASTM)

ASTM D698	Standard Test Methods for laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

Advisory Circulars (AC)

AC 150/5370-2G Operational Safety on Airports During Construction Software

Software

FAARFIELD – FAA Rigid and Flexible Iterative Elastic Layered Design

U.S. Department of Transportation

FAA RD-76-66 Design and Construction of Airport Pavements on Expansive Soils

END OF ITEM P-152

ITEM P-209

CRUSHED AGGREGATE BASE COURSE

DESCRIPTION

209-1.1 This item consists of a base course composed of crushed aggregate base constructed on a prepared course in accordance with these specifications and in conformity to the dimensions and typical cross-sections shown on the plans.

MATERIALS

209-2.1 **Crushed Aggregate Base**. Crushed aggregate shall consist of clean, sound, durable particles of crushed stone, crushed gravel, and shall be free from coatings of clay, silt, organic material, clay lumps or balls or other deleterious materials or coatings. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as consistent and uniform as practicable. Fine aggregate portion, defined as the portion passing the No. 4 sieve shall consist of fines from the coarse aggregate crushing operation. The fine aggregate shall be produced by crushing stone, gravel that meet the coarse aggregate requirements for wear and soundness. Aggregate base material requirements are listed in the following table.

Crushed Aggregate Base Material Requirements

Material Test	Requirement	Standard
Coarse Aggregate		
Resistance to Degradation	Loss: 45% maximum	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate	ASTM C88
Percentage of Fractured Particles	Minimum 90% by weight of particles with at least two fractured faces and 98% with at least one fractured face[1]	ASTM D5821
Flat Particles, Elongated Particles, or Flat and Elongated Particles	10% maximum, by weight, of flat, elongated, or flat and elongated particles[2]	ASTM D4791
Fine Aggregate		
Liquid Limit	Less than or equal to 25	ASTM D4318
Plasticity Index	Not more than five (5)	ASTM D4318

[1] The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

[2] A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

209-2.2 Gradation Requirements. The gradation of the aggregate base material shall meet the requirements of the gradation given in the following table when tested per ASTM C117 and ASTM C136. The gradation shall be well graded from coarse to fine and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa.

Gradation of Aggregate Base

Sieve Size	Design Range Percentage by Weight passing	Contractor's Final Gradation	Job Control Grading Band Tolerances[1] (Percent)
2 inch	100		0
1-1/2 inch	95-100		±5
1 inch	70-95		±8
3/4 inch	55-85		±8
No. 4	30-60		±8
No. 40[2]	10-30		±5
No. 200[2]	0-10		±3

[1] The "Job Control Grading Band Tolerances for Contractor's Final Gradation" in the table shall be applied to "Contractor's Final Gradation" to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

[2] The fraction of material passing the No 200 sieve shall not exceed two-thirds the fraction passing the No 40 sieve.

209-2.3 Sampling and Testing.

A. Aggregate Base Materials. The Contractor shall take samples of the aggregate base in accordance with ASTM D75 to verify initial aggregate base requirements and gradation. Material shall meet the requirements in Paragraph 209-2.1. This sampling and testing will be the basis for approval of the aggregate base quality requirements.

B. Gradation Requirements. The Contractor shall take at least two aggregate base samples per day in the presence of the RPR/ENGINEER and complete gradation testing to check the final gradation. Sampling shall be per ASTM D75 and gradation testing shall per ASTMC117 and ASTM C136. Material shall meet the requirements in Paragraph 209-2.2. The samples shall be taken from the in-place, un-compacted material at sampling points and intervals designated by the ENGINEER.

209-2.4 Separation Geotextile. Not used.

CONSTRUCTION METHODS

209-3.1 Control Strip. The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the RPR/ENGINEER, that the materials, equipment, and construction processes meet the requirements of the specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR/ENGINEER must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted or removed and replaced at the Contractor's expense. Full operations shall not continue until the control strip has been accepted by the ENGINEER. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved by the ENGINEER.

209-3.2 Preparing Underlying Subgrade and/or Subbase. The underlying subgrade and/or subbase shall be checked and accepted by the ENGINEER before base course placing and spreading operations begin. Re-proof rolling of the subgrade or proof rolling of the subbase in accordance with Item P-152, at the Contractor's expense, may be required by the ENGINEER if the Contractor fails to ensure proper drainage or protect the subgrade and/or subbase. Any ruts or soft, yielding areas due to improper drainage conditions, hauling, or any other cause, shall be corrected before the base course is placed. To ensure

proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

209-3.3 Production. The aggregate shall be uniformly blended and, when at a satisfactory moisture content per Paragraph 209-3.5, the approved material may be transported directly to the placement.

209-3.4 Placement. The aggregate shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the ENGINEER, to a uniform thickness and width. The equipment shall have positive thickness controls to minimize the need for additional manipulation of the material. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

The aggregate shall meet gradation and moisture requirements prior to compaction. The base course shall be constructed in lifts as established in the control strip, but not less than 4 inches nor more than 12 inches of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications at the Contractor's expense.

209-3.5 Compaction. Immediately after completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density within the same day that the aggregate is placed on the subgrade.

The field density of each compacted lift of material shall be at least 100% of the maximum density of laboratory specimens prepared from samples of the base material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with ASTM D698. The moisture content of the material during placing operations shall be within ±2 percentage points of the optimum moisture content as determined by ASTM D698. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

209-3.6 Weather Limitations. Material shall not be placed unless the ambient air temperature is at least 40°F and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

209-3.7 Maintenance. The base course shall be maintained in a condition that will meet all specification requirements. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, prior to placement of additional material, the Contractor shall verify that materials still meet all specification requirements. Equipment may be routed over completed sections of base course, provided that no damage results and the equipment is routed over the full width of the completed base course. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at the Contractor's expense.

209-3.8 Surface Tolerances. After the course has been compacted, the surface shall be tested for smoothness and accuracy of grade and crown by the Contractor. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR/ENGINEER. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and recompacted to grade until the required smoothness and accuracy are provided to and approved by the ENGINEER. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

A. Smoothness. The finished surface shall not vary more than 3/8-inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

B. Grade. The grade and crown shall be measured on a 50-foot grid and shall be within +0 and -1/2 inch of the specified grade.

209-3.9 Acceptance Sampling and Testing. Crushed aggregate base course shall be accepted for density and thickness on an area basis. Two tests shall be made for density and thickness for each 1000 square yards. Sampling locations will be determined on a random basis per ASTM D3665.

A. Density. The ENGINEER shall perform all density tests for acceptance.

Each area shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per ASTM D698. The in-place field density shall be determined per ASTM D1556 or ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the area represented by the failed test must be reworked and/or recompacted and two additional

random tests made. This procedure shall be followed until the specified density is reached. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

B. Thickness. Depth tests shall be made by test holes at least 3 inches in diameter that extend through the base. The thickness of the base course shall be within +0 and -1/2 inch of the specified thickness as determined by depth tests taken by the Contractor in the presence of the RPR/ENGINEER for each area. Where the thickness is deficient by more than 1/2-inch, the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches, adding new material of proper gradation, and the material shall be blended and recompacted to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.

METHOD OF MEASUREMENT

209-4.1 The quantity of crushed aggregate base course will be determined by measurement of the number of cubic yards of material actually constructed at the specified depth and accepted by the ENGINEER as complying with the plans and specifications. Base materials shall not be included in any other excavation quantities.

BASIS OF PAYMENT

209-5.1 Payment shall be made at the contract unit price per cubic yard for crushed aggregate base course. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-209-5.1 Crushed Aggregate Base Course - per Cubic Yard

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM C29	Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate

ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D5821	Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

American Association of State Highway and Transportation Officials (AASHTO)

M288 Standard Specification for Geosynthetic Specification for Highway Applications

END OF ITEM P-209

ITEM PMBP

PLANT MIX BITUMINOUS PAVEMENTS

DESCRIPTION

1.1 This item shall consist of a surface course composed of mineral aggregate and bituminous material mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross sections shown on the plans. Each course shall be constructed to the depth, typical section, or elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course.

MATERIALS

2.1 **AGGREGATE.** Aggregates shall consist of crushed stone, crushed gravel, or crushed slag with or without sand or other inert finely divided mineral aggregate. The portion of materials retained on the No. 8 sieve shall be known as coarse aggregate. The portion passing the No. 8 sieve and retained on the No. 200 sieve shall be known as fine aggregate, and the portion passing the No. 200 sieve as mineral filler.

a. Coarse Aggregate. Coarse aggregate shall consist of sound, tough, durable particles, free from adherent films of matter that would prevent thorough coating with the bituminous material. The percentage of wear shall not be greater than 45% when tested in accordance with ASTM C 131. The sodium sulfate soundness loss shall not exceed 9%, after 5 cycles, when tested in accordance with ASTM C 88.

Aggregate shall contain at least 50% by weight of crushed pieces having two or more fractured faces and 65% having at least one fractured face. The area of each face shall be equal to at least 75% of the smallest midsectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces. Fractured faces shall be obtained by artificial crushing.

The aggregate shall not contain more than 8%, by weight, of flat or elongated pieces; a flat particle is one having a ratio of width to thickness greater than five, an elongated particle is one having a ratio of length to width greater than five.

Slag shall be air-cooled, blast furnace slag, and shall have a compacted weight of not less than 70 pounds per cubic foot when tested in accordance with ASTM C 29.

b. Fine Aggregate. Fine aggregate shall consist of clean, sound, durable, angular particles produced by crushing stone, or gravel that meets the requirements for wear and soundness specified for coarse aggregate. The aggregate particles shall be free from coatings of clay, silt, or other objectionable matter and shall contain no clay balls or organic matter. The fine aggregate, including any blended filler, shall have a plasticity index of not more than six and a liquid limit of not more than 25 when tested in accordance with ASTM D 4318.

Natural sand may be used to obtain the gradation of the aggregate blend or to improve the workability of the mix. The amount of natural sand in the mix shall not exceed 15% of the total fine aggregate.

c. Sampling and Testing. ASTM D 75 shall be used in sampling coarse and fine aggregate, and ASTM C 183 shall be used in sampling mineral filler. The Contractor shall furnish documentation to the ENGINEER confirming that the aggregates meet specification requirements.

d. Sources of Aggregates. Sources of aggregates shall be selected well in advance of the time the materials are required in the work. When the aggregates are obtained from a previously approved source or an existing source producing aggregates that has a satisfactory service record in airport bituminous pavement construction for at least 5 years, samples shall be submitted 15 days prior to start of production. An inspection of the producer's operation may be made by the ENGINEER. When new sources are to be developed, the Contractor shall indicate the sources and shall submit a plan for operation 30 days in advance of starting production. Samples from test pits, borings, and other excavations shall be submitted at the same time. Approval of the source of aggregate does not relieve the Contractor in any way of the responsibility for delivery at the job site of aggregates that meet the requirements specified herein.

e. Samples of Aggregates. Samples of aggregates shall be furnished by the Contractor at the start of production and at intervals during production of bituminous mixtures. The sampling points and intervals will be designated by the ENGINEER. The samples will be the basis of approval of specific lots of aggregates from the standpoint of the quality requirements of this section.

2.2 FILLER. If filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D 242.

2.3 BITUMINOUS MATERIAL. Bituminous material shall conform to the following requirements: Viscosity Grade AC-20 meeting the requirements of Section 1020 of the North Carolina Department of Transportation "Standard Specifications for Roads and Structures".

The Contractor shall furnish vendor's certified test reports for each tankload of bitumen shipped to the project. The report shall be delivered to the ENGINEER before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall be the basis for final acceptance.

COMPOSITION

3.1 COMPOSITION OF MIXTURE. The bituminous plant mix shall be composed of a mixture of aggregate, filler if required, and bituminous material. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula.

3.2 JOB MIX FORMULA. No bituminous mixture for payment shall be produced until a job mix formula has been approved by the ENGINEER. The formula shall be submitted in writing by the Contractor to the ENGINEER at least 15 days prior to the start of paving operations and shall indicate the definite percentage of each sieve fraction of aggregate, the percentage of bitumen, and the temperature of the completed mixture when discharged from the mixer. All test data used to develop the job mix formula shall also be submitted. The job mix formula for each mixture shall be in effect until modified in writing by the ENGINEER. Should a change in sources of materials be made, a new job mix formula must be established before the new material is used.

The bituminous mixture shall be designed using procedures contained in Chapter III, MARSHALL METHOD OF MIX DESIGN, of the Asphalt Institute's Manual Series No. 2 (MS-2), current edition, and shall *meet all of the requirements of the North Carolina Department of Transportation requirements for bituminous concrete surface course, Type S-9.5C*, except as modified in Table 1.

Table 1. Marshall Design Criteria

Test Property	Value
Number of Blows	75
Stability, Minimum pounds	1,800
Flow, 0.01 in.	8-16
Percent air voids	5

3.2.1 GRADATION AND JOB MIX FORMULA. The bituminous concrete aggregate gradation and job mix formula shall meet the requirements of the current North Carolina Department of Transportation Standard Specifications for bituminous concrete surface course Type S9.5C.

Deviation from the final approved design for bitumen content and gradation of

aggregates shall not be greater than the tolerances permitted and shall be based on daily plant extraction. Extraction tests for bitumen content and aggregate gradation will be made at least twice daily. The mixture will be tested for bitumen content in accordance with ASTM D 2172 and for aggregate gradation in accordance with AASHTO T 30.

The completed mixture shall be sampled at the plant to retain job control. One sample shall be taken from each sublot on a random basis, in accordance with procedures contained in ASTM D 3665. A lot shall consist of the tonnage from one day's paving and shall be divided into 2 sublots. Testing shall be in accordance with the Marshall Method procedures contained in Chapter III of the Asphalt Institute Manual Series No. 2 (MS-2), current edition. If any Marshall test results of any property do not conform to the job mix formula tolerances, the Contractor shall take immediate corrective action.

The ENGINEER may halt production if the Marshall test criteria are not met and not allow it to resume until the problem is corrected.

If the index of retained strength of the specimens of composite mixture, as determined by ASTM D 1075, is less than 75, the aggregates shall be rejected or the asphalt shall be treated with an antistripping agent. The amount of antistripping agent added to the asphalt shall be sufficient to produce an index of retained strength of not less than 75.

3.3 TEST SECTION. Prior to full production, the Contractor shall prepare a quantity of bituminous mixture according to the job mix formula. The amount of mixture should be sufficient to construct a test section 50 long and 20 wide placed in two sections and shall be of the same depth specified for the construction of the course which it represents. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented by the test section. The equipment used in construction of the test section shall be the same type and weight to be used on the remainder of the course represented by the test section.

If the test section should prove to be unsatisfactory, the necessary adjustments to the mix design, plant operation, and/or rolling procedures shall be made. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. *When test sections do not conform to specification requirements, the pavement shall be removed and replaced at the Contractor's expense*. Full production shall not begin without the ENGINEER'S approval.

3.4 TESTING LABORATORY. The testing laboratory used to develop the job mix formula and to perform the tests required by this specification shall meet the requirements of ASTM D 3666. A certification that the laboratory meets these requirements shall be submitted to the ENGINEER. An approved testing

laboratory will not be required for quality control tests made by the Contractor.

CONSTRUCTION METHODS

4.1 WEATHER LIMITATIONS. The bituminous mixture shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 5. The temperature requirements may be waived, but only at the discretion of the ENGINEER.

Table 5. Base Temperature Limitations

Mat Thickness	Base Temperature (Minimum Degrees F)
Greater than 1 inch	45
1 inch or less	50

4.2 BITUMINOUS MIXING PLANT. Plants used for the preparation of bituminous mixtures shall conform to the requirements of ASTM D 995 with the following changes:

a. Requirements for All Plants.

(1) Truck Scales. The bituminous mixture shall be weighed on approved scales furnished by the Contractor, or on public scales at the Contractor's expense. Such scales shall be inspected and sealed as often as the ENGINEER deems necessary to assure their accuracy. Scales shall conform to the requirements of Section 90.

(2) Testing Laboratory. The Contractor or producer shall provide laboratory facilities for control and acceptance testing functions during periods of mix production, sampling, and testing and whenever materials subject to the provisions of these specifications are being supplied or tested. The laboratory shall provide adequate equipment, space, and utilities as required for the performance of the specified tests.

(3) Inspection of Plant. The ENGINEER, or his/her authorized representative, shall have access at all times to all parts of the plant for checking adequacy of equipment and inspecting operation of the plant: verifying weights, proportions, and character of materials, and checking the temperatures maintained in the preparation of the mixtures.

(4) Storage Bins and Surge Bins. Paragraph 3.9 of ASTM D 995 is deleted. Instead, the following applies. Use of surge bins or storage bins for temporary storage of hot bituminous mixtures will be permitted as follows:

(1) The bituminous mixture may be stored in surge bins for period of time not to exceed 3 hours,

(2) The bituminous mixture may be stored in insulated storage bins for a period of time not to exceed 24 hours, provided an inert gas atmosphere is maintained in the bin during the storage period.

The bins shall be such that mix drawn from them meets the same requirements as mix loaded directly into trucks.

If the ENGINEER determines that there is an excessive amount of heat loss, segregation or oxidation of the mixture due to temporary storage, no overnight storage will be allowed.

4.3 HAULING EQUIPMENT. Trucks used for hauling bituminous mixtures shall have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated and covers shall be securely fastened.

4.4 BITUMINOUS PAVERS. Bituminous pavers shall be self-contained, power-propelled units with an activated screed or strike-off assembly, heated if necessary, and shall be capable spreading and finishing courses of bituminous plant mix material which will meet the specified thickness, smoothness, and grade. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of bituminous plant mix material in widths shown on the plans.

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed. The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

The paver shall be capable of operating at forward speeds consistent with satisfactory laying of the mixture.

An automatic grade control device shall be used and the paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated by mechanical sensors and a reference line.

The controls shall be capable of working in conjunction with any of the following

attachments:

a. Ski-type device of not less than thirty (30') feet in length or as directed by the ENGINEER.

b. Taut stringline (wire) set to grade.

c. Short ski or shoe.

The Contractor will be required to use automatic grade control sensors for this project. On the first paving lane for each taxiway or taxilane, the Contractor shall use a taut stringline (wire) on both sides of the paver. If the first lane is adjacent to a building floor slab, the Contractor shall use a shoe on the building slab and a stringline (wire) on the other side of the paver. On the remaining lanes the Contractor shall use a shoe on the previously placed paving lane and a stringline (wire) on the other side of the paver. The stringline (wire) shall have grade pins at twenty five (25') feet on center (maximum).

4.5 ROLLERS. Rollers of the vibratory, steel wheel, or pneumatic-tired type may be used. They shall be in good condition, capable of operating at slow speeds to avoid displacement of the bituminous mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.

The use of equipment which causes excessive crushing of the aggregate will not be permitted.

4.6 PREPARATION OF BITUMINOUS MATERIAL. The bituminous material shall be heated in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature. The temperature of the bituminous material delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles but shall not exceed 325° F.

4.7 PREPARATION OF MINERAL AGGREGATE. The aggregate for the mixture shall be dried and heated to the temperature designated by the job formula within the job tolerance specified. The maximum temperature and rate of heating shall be such that no permanent damage occurs to the aggregates. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

4.8 PREPARATION OF BITUMINOUS MIXTURE. The aggregates and the bituminous material shall be weighed or metered and introduced into the mixer in

the amount specified by the job mix formula.

The combined materials shall be mixed until the aggregate obtains a uniform coating of bitumen and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture. It shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, and approved by the ENGINEER for each individual plant and for each type of aggregate used. The minimum mixing time shall be 25 seconds. The mixing time will be set to achieve 95% of coated particles. For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer. *The moisture content of the mix shall not exceed 1.0%*.

4.9 TRANSPORTING, SPREADING, AND FINISHING. The mixture shall be transported from the mixing plant to the point of use in vehicles conforming to the requirements of Section 4.3. Deliveries shall be scheduled so that spreading and rolling of all mixture prepared for one day's run can be completed during daylight. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

Immediately before placing the bituminous mixture, the underlying course shall be cleared of all debris with power blowers, power brooms, or hand brooms as directed.

The mix shall be placed at a temperature of not less than 250° F. Upon arrival, the mixture shall be spread to the full width by an approved bituminous paver. It shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the bituminous mat. Unless otherwise directed, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 except where edge lanes require less width to complete the area. The longitudinal joint in one layer shall offset that in the layer immediately below by at least 1 foot however, the joint in the top layer shall be at the centerline of the pavement. Transverse joints in one layer shall be offset by at least two (2') feet from transverse joints in the previous layer. Transverse joints in adjacent lanes shall be offset a minimum of ten (10') feet.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread, raked, and luted by hand tools.

4.10 COMPACTION OF MIXTURE. After spreading, the mixture shall be thoroughly

and uniformly compacted by rolling. The surface shall be rolled when the mixture has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor.

The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once.

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until all roller marks are eliminated, the surface is of uniform texture and true to grade and cross section, and the required field density is obtained.

To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened, but excessive water will not be permitted.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with hot hand tampers.

Any mixture that becomes loose and broken, mixed with dirt, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. *Skin patching shall not be allowed*.

The Contractor shall provide at his own expense a nuclear density gauge and an experienced operator to help establish the rolling pattern during all paving operations. This exercise will not serve as a density verification for determination of acceptance or payment, but only aids the Contractor in establishing the rolling pattern required to obtain the specified density.

4.11 JOINTS. The formation of all joints shall be made in such a manner as to ensure a continuous bond between old and new sections of the course. All joints shall have the same texture, density, and smoothness as other sections of the course.

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course, in which case the edge shall be cut back to its full depth and width on a straight line to expose a vertical face. In both methods all contact surfaces shall be given a tack coat of bituminous material before placing any fresh mixture against the joint.

Longitudinal joints which are irregular, damaged, or otherwise defective shall be cut back to expose a clean, sound surface for the full depth of the course. All

contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.

4.12 ACCEPTANCE SAMPLING AND TESTING OF BITUMINOUS MIXTURE (DENSITY). Bituminous concrete will be accepted for density on a random test location basis. The paving for this project will be considered as one lot. Four core samples shall be taken.

Pavement density will be determined by taking, for each lot, the density of the laboratory-prepared specimen, taken from the truck delivering mixture to the site. The specimen will be compacted in accordance with ASTM D 1559, Section 3.5, except that the temperature of the mixture immediately prior to compaction shall be 250° F ±5 degrees. The sample mixture can be placed in an oven for not more than 30 minutes to maintain the heat, but it shall not be reheated if it cools before use.

Compacted pavement will be accepted, with respect to density, when the average field density is equal to or greater than 94% of the average density of the laboratory-prepared specimens, and when no individual determination deviates more than 1.8% from the average field density. Cores taken from the pavement will be used to test the field density. The density of the laboratory-prepared specimens and the core samples will be determined in accordance with ASTM D 2726 or D 1188, whichever is applicable. See Table 7 - Sliding Scale Pay Factors.

Bituminous mixture sampled for laboratory specimens and the location of sampling sites within a lot's placement area shall be chosen on a random basis in accordance with the procedures contained in Appendix C of the Asphalt Institute's Specification Series No. 1 (SS-1), Fifth Edition. Cores will be taken in accordance with the requirements of Section 4.13.

4.13 SAMPLING PAVEMENT. Samples for determination of thickness and density of completed pavements shall be obtained by the Contractor at no extra cost. The size, number, and locations of the samples will be as directed by the ENGINEER. Samples shall be neatly cut with a core drill, or other approved equipment. The Contractor shall furnish all tools, labor, and materials for cutting samples and replacing pavement.

All laboratory tests necessary to determine conformance with requirements specified herein will be performed without cost to the Contractor.

Samples shall be removed by the Contractor and delivered by the Contractor to the OWNER'S laboratory technician within four hours after the final rolling operation over the pavement from which the sample was taken, unless the Resident Project Representative authorizes the samples to be delivered the following day. Prior to the cutting of samples, the area of pavement from which

the samples will be taken shall be cooled with ice or by other appropriate means so that the removal will not damage the sample. The samples shall be delivered to the laboratory technician in an undamaged condition. If the Resident Project Representative authorizes delivery of a sample the following day, the sample shall be delivered to the laboratory technician prior to 9:00 a.m. All samples shall be appropriately marked or identified so that the exact location from which the sample was taken can be readily recorded by the laboratory technician. The tests conducted shall include stability, flow, unit weight, voids in the total mix and percent voids filled with bitumen. Tolerances cited previously are allowable for the continuation of plant production.

Table 7. Sliding Scale Pay Factors

Average Percent Density	**Recommended Percent Payment**
98.0 and greater	100
97.0 - 97.9	98
96.0 - 96.9	90
95.0 - 95.9	75
Less than 95.0	REJECT
Deviation from Average Percent Density 1/	**Recommended Percent Payment**
0 - 1.8	100
1.9 - 2.3	98
2.4 - 2.7	95
2.8 - 3.1	90
3.2	2/

1/ For 2 samples
2/ If the deviation from the average percent density is greater than 3.2%, it will be the ENGINEER'S option to accept or reject at 90% payment
3/ Deductions for insufficient density and excessive deviation shall be cumulative deductions.

4.14 SURFACE TESTS. Tests for conformity with the specified crown and grade shall be made by the Contractor immediately after initial compaction. Any variation shall be corrected by the removal or addition of materials and by continuous rolling.

The finished surface shall not vary more than ¼ inch for the surface course when tested with a sixteen (16') foot straightedge applied parallel with, or at right angles to, the centerline. Prior to beginning paving operations, the Contractor shall provide a sixteen (16') foot straightedge to be used in performing the surface tests.

After the completion of final rolling, the smoothness of the course shall be tested by the Contractor; humps or depressions exceeding the specified tolerances shall be immediately corrected by removing the defective work and replacing with new material, as directed by the ENGINEER. This shall be done at the Contractor's expense. The Contractor shall test the pavement surface in the presence of the Resident Project Representative whenever requested by the Resident Project Representative.

The finished surfaces of bituminous courses shall not vary from the gradeline, elevations, and cross sections shown on the contract drawings by more than one half (½") inch. The Contractor shall correct pavement areas varying in excess of this amount by paving and replacing the defective work. Skin patching will not be permitted.

METHOD OF MEASUREMENT

5.1 Plant mix bituminous concrete pavement shall be measured by the number of tons of bituminous mixture used in the accepted work. Recorded batch weights or truck scale weights will be used to determine the basis for the tonnage.

BASIS OF PAYMENT

6.1 Payment for an accepted bituminous concrete pavement shall be made at the full or adjusted contract unit price per ton. The price shall be full compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item PMBP-6.1	Bituminous Surface Course (NCDOT Type S-9.5C) - per Ton

TESTING REQUIREMENTS

ASTM C 29	Unit Weight of Aggregate
ASTM C 88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 131	Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine
ASTM C 136	Sieve or Screen Analysis of Fine and Coarse Aggregates

ASTM C 183	Sampling Hydraulic Cement
ASTM D 75	Sampling Aggregates
ASTM D 995	Requirements for Mixing Plants for Hot-Mixed Hot-Laid Bituminous Paving Mixtures
ASTM D 1075	Effect of Water on Cohesion of Compacted Bituminous Mixtures
ASTM D 1188	Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
ASTM D 1559	Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D 2172	Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2489	Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D 2726	Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
ASTM D 3665	Random Sampling of Paving Materials
ASTM D 3666	Inspection and Testing Agencies for Bituminous Paving Materials
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils
AASHTO T 30	Mechanical Analysis of Extracted Aggregate

The Asphalt Mix Design Methods for Asphalt Institute's Concrete Manual No. 2 (MS-2).

MATERIAL REQUIREMENTS

ASTM D 242	Mineral Filler for Bituminous Paving Mixtures
ASTM D 490	Tar
ASTM D 946	Asphalt Cement for Use in Pavement Construction

ASTM D 3381	Viscosity-Graded Asphalt Cement for Use in Pavement Construction

END OF ITEM PMBP

ITEM P-602

EMULSIFIED ASPHALT PRIME COAT

DESCRIPTION

602-1.1 This item shall consist of an application of emulsified asphalt material on the prepared base course in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

MATERIALS

602-2.1 Emulsified Asphalt Material. The emulsified asphalt material shall be as specified in ASTM D3628 for use as a prime coat appropriate to local conditions. The Contractor shall provide a copy of the Manufacturer's Certificate of Analysis (COA) for the emulsified asphalt material. The COA shall be provided to and approved by the ENGINEER before the emulsified asphalt material is applied. The furnishing of the COA for the emulsified asphalt material shall not be interpreted as a basis for final acceptance. The Manufacturer's COA may be subject to verification by testing the material delivered for use on the project.

CONSTRUCTION METHODS

602-3.1 Weather Limitations. The emulsified asphalt prime coat shall be applied only when the existing surface is dry; the atmospheric temperature is 50°F or above, and the temperature has not been below 35°F for the 12 hours prior to application; and when the weather is not foggy or rainy. The temperature requirements may be waived when directed by the ENGINEER.

602-3.2 Equipment. The equipment shall include a self-powered pressure asphalt material distributor and equipment for heating asphalt material.

Provide a distributor with pneumatic tires of such size and number that the load produced on the base surface does not exceed 65.0 psi of tire width to prevent rutting, shoving or otherwise damaging the base, surface or other layers in the pavement structure. Design and equip the distributor to spray the asphalt material in a uniform coverage at the specified temperature, at readily determined and controlled rates from 0.05 to 1.0 gallons per square yard, with a pressure range of 25 to 75 psi and with an allowable variation from the specified rate of not more than ±5%, and at variable widths. Include with the distributor equipment a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying asphalt material manually to

areas inaccessible to the distributor. Equip the distributor to circulate and agitate the asphalt material during the heating process. If the distributor is not equipped with an operable quick shutoff valve, the prime operations shall be started and stopped on building paper.

A power broom and power blower suitable for cleaning the surfaces to which the asphalt coat is to be applied shall be provided.

Asphalt distributors must be calibrated annually in accordance with ASTM D2995. The Contractor must furnish a current calibration certification for the asphalt distributor truck from any State or other agency as approved by the ENGINEER.

602-3.3 Application of Emulsified Asphalt Material. Immediately before applying the prime coat, the full width of the surface to be primed shall be swept with a power broom to remove all loose dirt and other objectionable material.

The asphalt emulsion material shall be uniformly applied with an asphalt distributor at the rate of 0.15 to 0.30 gallons per square yard depending on the base course surface texture. The type of asphalt material and application rate shall be approved by the ENGINEER prior to application.

Following application of the emulsified asphalt material and prior to application of the succeeding layer of pavement, allow the asphalt coat to cure and to obtain evaporation of any volatiles or moisture. Maintain the coated surface until the succeeding layer of pavement is placed, by protecting the surface against damage and by repairing and recoating deficient areas. Allow the prime coat to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course. Furnish and spread sand to effectively blot up and cure excess asphalt material. The Contractor shall remove blotting sand prior to asphalt concrete lay down operations at no additional expense to the Owner. Keep traffic off surfaces freshly treated with asphalt material. Provide sufficient warning signs and barricades so that traffic will not travel over freshly treated surfaces.

602-3.4 Trial Application Rates. The Contractor shall apply a minimum of three lengths of at least 100 feet for the full width of the distributor bar to evaluate the amount of emulsified asphalt material that can be satisfactorily applied with the equipment. Apply three different application rates of emulsified asphalt materials within the application range specified in Paragraph 602-3.3. Other trial applications can be made using various amounts of material as directed by the ENGINEER. The trial application is to demonstrate the equipment can uniformly apply the emulsified asphalt material within the rates specified and determine the application rate for the project.

602-3.5 Freight and Waybills. The Contractor shall submit waybills and delivery tickets during the progress of the work. Before the final estimate is allowed, file with the RPR certified waybills and certified delivery tickets for all emulsified asphalt materials used in the construction of the pavement covered by the contract. Do not remove emulsified asphalt material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.

METHOD OF MEASUREMENT

602-4.1 The emulsified asphalt material for prime coat shall be measured by the gallon. Volume shall be corrected to the volume at 60°F in accordance with ASTM D4311. The emulsified asphalt material paid for will be the measured quantities used in the accepted work, provided that the measured quantities are not 10% over the specified application rate. Any amount of emulsified asphalt material more than 10% over the specified application rate for each application will be deducted from the measured quantities, except for irregular areas where hand spraying of the emulsified asphalt material is necessary. Water added to emulsified asphalt will not be measured for payment.

BASIS OF PAYMENT

602-5.1 Payment shall be made at the contract unit price per gallon for emulsified asphalt prime coat. This price shall be full compensation for furnishing all materials and for all preparation, delivering, and applying the materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

Payment will be made under:

Item P-602-5.1 Emulsified Asphalt Prime Coat – per Gallon

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM D2995 Standard Practice for Estimating Application Rate and Residual Application Rate of Bituminous Distributors

ASTM D3628 Standard Practice for Selection and Use of Emulsified Asphalts

END OF ITEM P-602

ITEM P-610

CONCRETE FOR MISCELLANEOUS STRUCTURES

DESCRIPTION

610-1.1 This item shall consist of concrete and reinforcement, as shown on the plans, prepared, and constructed in accordance with these specifications. This specification shall be used for all concrete other than airfield pavement which are cast-in-place.

MATERIALS

610-2.1 **General**. Only approved materials, conforming to the requirements of these specifications, shall be used in the work. Materials may be subject to inspection and tests at any time during their preparation or use. The source of all materials shall be approved by the ENGINEER before delivery or use in the work. Representative preliminary samples of the materials shall be submitted by the Contractor, when required, for examination and test. Materials shall be stored and handled to ensure preservation of their quality and fitness for use and shall be located to facilitate prompt inspection. All equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed in them.

The use of pit-run aggregates shall not be permitted unless the pit-run aggregate has been screened and washed, and all fine and coarse aggregates stored separately and kept clean. The mixing of different aggregates from different sources in one storage stockpile or alternating batches of different aggregates shall not be permitted.

A. Reactivity. Fine aggregate and coarse aggregates to be used in all concrete shall have been tested separately within six months of the project in accordance with ASTM C1260. Test results shall be submitted to the ENGINEER. The aggregate shall be considered innocuous if the expansion of test specimens, tested in accordance with ASTM C1260, does not exceed 0.08% at 14 days (16 days from casting). If the expansion either or both test specimen is greater than 0.08% at 14 days, but less than 0.20%, a minimum of 25% of Type F fly ash, or between 40% and 55% of slag cement shall be used in the concrete mix.

If the expansion is greater than 0.20%, the aggregates shall not be used, and test results for other aggregates must be submitted for evaluation; or aggregates that meet P-501 reactivity test requirements may be utilized.

610-2.2 Coarse Aggregate. The coarse aggregate for concrete shall meet the requirements of ASTM C33 and the requirements of Table 4, Class Designation 5S; and the grading requirements shown below, as required for the project.

Coarse Aggregate Grading Requirements

Maximum Aggregate Size	ASTM C33, Table 3 Grading Requirements (Size No.)
1 1/2 inch	467 or 4 and 67
1 inch	57
¾ inch	67
½ inch	7

610-2.2.1 Coarse Aggregate Susceptibility to Durability (D) Cracking.

Coarse aggregate may only be accepted from sources that have a 20-year service history for the same gradation to be supplied with no history of D-Cracking. Aggregates that do not have a 20-year record of service free from major repairs (less than 5% of slabs replaced) in similar conditions without D-cracking shall not be used unless the material currently being produced has a durability factor greater than or equal to 95 per ASTM C666. The Contractor shall submit a current certification and test results to verify the aggregate acceptability. Test results will only be accepted from a State Department of Transportation (DOT) materials laboratory or an accredited laboratory. Certification and test results which are not dated, or which are over one (1) year old or which are for different gradations will not be accepted.

Crushed granite, calcite cemented sandstone, quartzite, basalt, diabase, rhyolite, or trap rock are considered to meet the D-cracking test requirements but must meet all other quality tests specified in Item P-501.

610-2.3 Fine Aggregate. The fine aggregate for concrete shall meet all fine aggregate requirements of ASTM C33.

610-2.4 Cement. Cement shall conform to the requirements of ASTM C150 Type I, IA, II, IIA, III, IIIA, and V.

610-2.5 Cementitious Materials.

A. Fly Ash. Fly ash shall meet the requirements of ASTM C618, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash shall have a Calcium Oxide (CaO) content of less than [15%] and a

total available alkali content less than 3% per ASTM C311. Fly ash produced in furnace operations using liming materials or soda ash (sodium carbonate) as an additive shall not be acceptable. The Contractor shall furnish the previous three most recent, consecutive ASTM C618 reports for each source of fly ash proposed in the concrete mix and shall furnish each additional report as they become available during the project. The reports can be used for acceptance or the material may be tested independently by the ENGINEER.

B. Slag Cement (Ground Granulated Blast Furnace (GGBF)). Slag cement shall conform to ASTM C989, Grade 100 or Grade 120. Slag cement shall be used only at a rate between 25% and 55% of the total cementitious material by mass.

610-2.6 Water. Water used in mixing or curing shall be from potable water sources. Other sources shall be tested in accordance with ASTM C1602 prior to use.

610-2.7 Admixtures. The Contractor shall submit certificates indicating that the material to be furnished meets all of the requirements indicated below. In addition, the ENGINEER may require the Contractor to submit complete test data from an approved laboratory showing that the material to be furnished meets all of the requirements of the cited specifications. Subsequent tests may be made of samples taken by the ENGINEER from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.

A. Air-Entraining Admixtures. Air-entraining admixtures shall meet the requirements of ASTM C260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entrainment agent and any water reducer admixture shall be compatible.

B. Water-Reducing Admixtures. Water-reducing admixture shall meet the requirements of ASTM C494, Type A, B, or D. ASTM C494, Type F and G high range water reducing admixtures and ASTM C1017 flowable admixtures shall not be used.

C. Other Chemical Admixtures. The use of set retarding, and set-accelerating admixtures shall be approved by the ENGINEER. Retarding shall meet the requirements of ASTM C494, Type A, B, or D and set-accelerating shall meet the requirements of ASTM C494, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

610-2.8 Premolded Joint Material. Premolded joint material for expansion joints shall meet the requirements of ASTM D1751 or ASTM D1752

610-2.9 Joint Filler. The filler for joints shall meet the requirements of Item P-605, unless otherwise specified.

610-2.10 Steel Reinforcement. Reinforcing shall consist of Reinforcing steel conforming to the requirements of ASTM A615.

610-2.11 Materials for Curing Concrete. Curing materials shall conform to one or more of the following:

Materials for Curing

Waterproof paper	**ASTM C171**
Clear or white Polyethylene Sheeting	**ASTM C171**
White-pigmented Liquid Membrane-Forming Compound, Type 2, Class B	**ASTM C309**

CONSTRUCTION METHODS

610-3.1 General. The Contractor shall furnish all labor, materials, and services necessary for, and incidental to, the completion of all work as shown on the drawings and specified here. All machinery and equipment used by the Contractor on the work, shall be of sufficient size to meet the requirements of the work. All work shall be subject to the inspection and approval of the ENGINEER.

610-3.2 Concrete Mixture. The concrete shall develop a compressive strength of 4000 psi in 28 days as determined by test cylinders made in accordance with ASTM C31 and tested in accordance with ASTM C39. The concrete shall contain not less than 470 pounds of cementitious material per cubic yard . The water cementitious ratio shall not exceed 0.45 by weight. The air content of the concrete shall be 5% +/- 1.2% as determined by ASTM C231 and shall have a slump of not more than 4 inches as determined by ASTM C143.

610-3.3 Mixing. Concrete may be mixed at the construction site, at a central point, or wholly or in part in truck mixers. The concrete shall be mixed and delivered in accordance with the requirements of ASTM C94 or ASTM C685.

The concrete shall be mixed only in quantities required for immediate use. Concrete shall not be mixed while the air temperature is below 40°F (without the ENGINEER's approval. If approval is granted for mixing under such conditions, aggregates, or water, or both, shall be heated and the concrete shall be placed at a temperature not less than 50°F nor more than 100°F. The Contractor shall be held responsible for any defective work, resulting from

freezing or injury in any manner during placing and curing, and shall replace such work at his expense.

Retempering of concrete by adding water or any other material is not permitted.

The rate of delivery of concrete to the job shall be sufficient to allow uninterrupted placement of the concrete.

610-3.4 Forms. Concrete shall not be placed until all the forms and reinforcements have been inspected and approved by the ENGINEER. Forms shall be of suitable material and shall be of the type, size, shape, quality, and strength to build the structure as shown on the plans. The forms shall be true to line and grade and shall be mortar-tight and sufficiently rigid to prevent displacement and sagging between supports. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes. The Contractor shall be responsible for their adequacy.

The internal form ties shall be arranged so no metal will show in the concrete surface or discolor the surface when exposed to weathering when the forms are removed. All forms shall be wetted with water or with a non-staining mineral oil, which shall be applied immediately before the concrete is placed. Forms shall be constructed so they can be removed without injuring the concrete or concrete surface.

610-3.5 Placing Reinforcement. All reinforcement shall be accurately placed, as shown on the plans, and shall be firmly held in position during concrete placement. Bars shall be fastened together at intersections. The reinforcement shall be supported by approved metal chairs. Shop drawings, lists, and bending details shall be supplied by the Contractor when required.

610-3.6 Embedded Items. Before placing concrete, all embedded items shall be firmly and securely fastened in place as indicated. All embedded items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The concrete shall be spaded and consolidated around and against embedded items. The embedding of wood shall not be allowed.

610-3.7 Concrete Consistency. The Contractor shall monitor the consistency of the concrete delivered to the project site; collect each batch ticket; check temperature; and perform slump tests on each truck at the project site in accordance with ASTM C143.

610-3.8 Placing Concrete. All concrete shall be placed during daylight hours, unless otherwise approved. The concrete shall not be placed until the depth and condition of foundations, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved by the RPR/ENGINEER. Concrete

shall be placed as soon as practical after mixing, but in no case later than one (1) hour after water has been added to the mix. The method and manner of placing shall avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes shall be used as an aid in placing concrete when necessary. The concrete shall not be dropped from a height of more than 5 feet. Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing. Do not subject concrete to procedures which cause segregation. Concrete shall be placed on clean, damp surfaces, free from running water, or on a properly consolidated soil foundation.

610-3.9 Vibration. Vibration shall follow the guidelines in American Concrete Institute (ACI) Committee 309R, Guide for Consolidation of Concrete.

610-3.10 Joints. Joints shall be constructed as indicated on the plans.

610-3.11 Finishing. All exposed concrete surfaces shall be true, smooth, and free from open or rough areas, depressions, or projections. All concrete horizontal plane surfaces shall be brought flush to the proper elevation with the finished top surface struck-off with a straightedge and floated.

610-3.12 Curing and Protection. All concrete shall be properly cured in accordance with the recommendations in American Concrete Institute (ACI) 308R, Guide to External Curing of Concrete. The concrete shall be protected from damage until project acceptance.

610-3.13 Cold Weather Placing. When concrete is placed at temperatures below 40°F, follow the cold weather concreting recommendations found in ACI 306R, Cold Weather Concreting.

610-3.14 Hot Weather Placing. When concrete is placed in hot weather greater than 85ºF, follow the hot weather concreting recommendations found in ACI 305R, Hot Weather Concreting.

QUALITY ASSURANCE (QA)

610-4.1 Quality Assurance Sampling and Testing. Concrete for each day's placement will be accepted on the basis of the compressive strength specified in Paragraph 610-3.2. The ENGINEER will sample the concrete in accordance with ASTM C172; test the slump in accordance with ASTM C143; test air content in accordance with ASTM C231; make and cure compressive strength specimens in accordance with ASTM C31; and test in accordance with ASTM C39. The QA testing agency will meet the requirements of ASTM C1077.

The Contractor shall provide adequate facilities for the initial curing of cylinders.

610-4.2 Defective Work. Any defective work that cannot be satisfactorily repaired as determined by the ENGINEER, shall be removed, and replaced at the Contractor's expense. Defective work includes, but is not limited to, uneven dimensions, honeycombing and other voids on the surface or edges of the concrete.

METHOD OF MEASUREMENT AND BASIS FOR PAYMENT

610-5.1 There will be no direct measurement for payment for any work covered by this item. The cost of any structural concrete used shall be included in the bid item to which it pertains. These prices shall be full compensation for furnishing all materials and for all preparation, delivery, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM A184 Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement

ASTM A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A704 Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement

ASTM A706 Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM A775 Standard Specification for Epoxy-Coated Steel Reinforcing Bars

ASTM A884 Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement

ASTM A934 Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars

ASTM A1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field

ASTM C33 Standard Specification for Concrete Aggregates

ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

ASTM C94 Standard Specification for Ready-Mixed Concrete

ASTM C136 Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates

ASTM C114 Standard Test Methods for Chemical Analysis of Hydraulic Cement

ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM C143 Standard Test Method for Slump of Hydraulic-Cement Concrete

ASTM C150 Standard Specification for Portland Cement

ASTM C171 Standard Specification for Sheet Materials for Curing Concrete

ASTM C172 Standard Practice for Sampling Freshly Mixed Concrete

ASTM C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete

ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C311 Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete

ASTM C494 Standard Specification for Chemical Admixtures for Concrete

ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

ASTM C666 Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

ASTM C685 Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing

ASTM C989 Standard Specification for Slag Cement for Use in Concrete and Mortars

ASTM C1017 Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete

ASTM C1077 Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation

ASTM C1157 Standard Performance Specification for Hydraulic Cement

ASTM C1260 Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

ASTM C1365 Standard Test Method for Determination of the Proportion of Phases in Portland Cement and Portland-Cement Clinker Using X-Ray Powder Diffraction Analysis

ASTM C1602 Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

ASTM D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types)

ASTM D1752 Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

American Concrete Institute (ACI)

ACI 305R Hot Weather Concreting

ACI 306R Cold Weather Concreting

ACI 308R Guide to External Curing of Concrete

ACI 309R Guide for Consolidation of Concrete

END OF ITEM P-610

ITEM D-701

PIPE FOR STORM DRAINS AND CULVERTS

DESCRIPTION

701-1.1 This item shall consist of the construction of pipe culverts and storm drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

MATERIALS

701-2.1 Materials shall meet the requirements shown on the plans and specified below. Underground piping and components used in drainage systems for terminal and aircraft fueling ramp drainage shall be noncombustible and inert to fuel in accordance with National Fire Protection Association (NFPA) 415.

701-2.2 **Pipe**. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements:

AASHTO R73	Standard Practice for Evaluation of Precast Concrete Drainage Productions
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C1479	Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations

701-2.3 **Concrete.** Concrete for pipe cradles shall have a minimum compressive strength of 2000 psi at 28 days and conform to the requirements of ASTM C94.

701-2.4 **Rubber Gaskets.** Rubber gaskets for rigid pipe shall conform to the requirements of ASTM C443. Confined O-ring gaskets shall be utilized for all concrete pipe.

701-2.5 **Joint Mortar.** Pipe joint mortar shall consist of one part Portland cement and two parts sand. The Portland cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

701-2.6 Joint Fillers. Poured filler for joints shall conform to the requirements of ASTM D6690.

701-2.7 Plastic Gaskets. Not used.

701-2.8. Controlled Low-Strength Material (CLSM). Not used.

701-2.9 Precast Box Culverts. Not Used.

701-2.10 Precast Concrete Pipe. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or American Concrete Pipe Association QCast Plant Certification program.

CONSTRUCTION METHODS

701-3.1 Excavation. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but it shall not be less than the external diameter of the pipe plus 12 inches on each side. The trench walls shall be approximately vertical.

The Contractor shall comply with all current federal, state, and local rules and regulations governing the safety of men and materials during the excavation, installation, and backfilling operations. Specifically, the Contractor shall observe that all requirements of the Occupational Safety and Health Administration (OSHA) relating to excavations, trenching, and shoring are strictly adhered to. The width of the trench shall be sufficient to permit satisfactorily jointing of the pipe and thorough compaction of the bedding material under the pipe and backfill material around the pipe, but it shall not be greater than the widths shown on the plans trench detail.

Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it from below the foundation grade for a depth of at least 8 inch or 1/2 inch for each foot of fill over the top of the pipe (whichever is greater) but for no more than three-quarters of the nominal diameter of the pipe. The excavation below grade should be filled with granular material to form a uniform foundation.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with approved granular material for the full trench width. The ENGINEER shall determine the depth of removal necessary. The granular material shall be compacted to provide adequate support for the pipe.

The excavation for pipes placed in embankment fill shall not be made until the embankment has been completed to a height above the top of the pipe as shown on the plans.

701-3.2 Bedding. The bedding surface for the pipe shall provide a foundation of uniform density to support the pipe throughout its entire length.

A. Rigid Pipe. The pipe bedding shall be constructed uniformly for the full length of the pipe barrel, as required on the plans. The maximum aggregate size shall be 1 inch when the bedding thickness is less than 6 inches, and 1-1/2 in when the bedding thickness is greater than 6 inches. Bedding shall be loosely placed uncompacted material under the middle third of the pipe prior to placement of the pipe.

B. Flexible Pipe. Not Used.

C. Other Pipe Materials. Not Used.

701-3.3 Laying Pipe. The pipe laying shall begin at the lowest point of the trench and proceed upgrade. The lower segment of the pipe shall be in contact with the bedding throughout its full length. Bell or groove ends of rigid pipes and outside circumferential laps of flexible pipes shall be placed facing upgrade.

Paved or partially lined pipe shall be placed so that the longitudinal center line of the paved segment coincides with the flow line.

Elliptical and elliptically reinforced concrete pipes shall be placed with the manufacturer's reference lines designating the top of the pipe within five degrees of a vertical plane through the longitudinal axis of the pipe.

701-3.4 Joining Pipe. Joints shall be made with rubber gaskets.

Mortar joints shall be made with an excess of mortar to form a continuous bead around the outside of the pipe and shall be finished smooth on the inside. Molds or runners shall be used for grouted joints to retain the poured grout. Rubber ring gaskets shall be installed to form a flexible watertight seal.

A. Concrete Pipe. Concrete pipe may be either bell and spigot or tongue and groove. Pipe sections at joints shall be fully seated and the inner surfaces flush and even. Concrete pipe joints shall be sealed with rubber gaskets meeting ASTM C443 when leak resistant joints are required.

B. Metal Pipe. Not Used.

C. PVC, Polyethylene, Or Polypropylene Pipe. Not Used.

D. Fiberglass Pipe. Not Used.

701-3.5 Embedment and Overfill. Pipes shall be inspected before any fill material is placed; any pipes found to be out of alignment, unduly settled, or damaged shall be removed and re-laid or replaced at the Contractor's expense.

701-3.5-1 Embedment Material Requirements

A. Concrete Pipe. Embedment material and compaction requirements shall be in accordance with the applicable Type of Standard Installation (Types 1, 2, 3, or 4) per ASTM C1479. If a concrete cradle or CLSM embedment material is used, it shall conform to the plan details.

B. Plastic and Fiberglass Pipe. Not Used.

C. Metal Pipe. Not Used.

701-3.5-2 Placement of Embedment Material. The embedment material shall be compacted in layers not exceeding 6 inches on each side of the pipe and shall be brought up one foot above the top of the pipe or to natural ground level, whichever is greater. Thoroughly compact the embedment material under the haunches of the pipe without displacing the pipe. Material shall be brought up evenly on each side of the pipe for the full length of the pipe.

When the top of the pipe is above the top of the trench, the embedment material shall be compacted in layers not exceeding 6 inches and shall be brought up evenly on each side of the pipe to one foot above the top of the pipe. All embedment material shall be compacted to a density required under Item P-152.

It shall be the Contractor's responsibility to protect installed pipes and culverts from damage due to construction equipment operations. The Contractor shall be responsible for installation of any extra strutting or backfill required to protect pipes from the construction equipment.

701-3.6 Overfill. Pipes shall be inspected before any overfill is in place. Any pipes found to be out of alignment, unduly settled, or damaged shall be removed and re-laid or replaced at the Contractor's expense. Evaluation of any damage to RCP shall be evaluated based on AASHTO R73.

Overfill material shall be place and compacted in layers as required to achieve compaction to at least 95 percent standard proctor per ASTM D698. The soil shall contain no debris, organic matter, frozen material, or stones with a

diameter greater than one half the thickness of the compacted layers being placed.

701-3.7 Inspection Requirements. An initial post installation inspection shall be performed by the Contractor no sooner than 30 days after completion of installation and final backfill. Clean or flush all lines prior to inspection.

Use a camera with lighting suitable to allow a clear picture of the entire periphery of the pipe interior. Center the camera in the pipe both vertically and horizontally and be able to pan and tilt to a 90 degree angle with the axis of the pipe rotating 360 degrees. Use equipment to move the camera through the pipe that will not obstruct the camera's view or interfere with proper documentation of the pipe's condition. The video image shall be clear, focused, and relatively free from roll, static, or other image distortion qualities that would prevent the reviewer from evaluating the condition of the pipe.

Reinforced concrete pipe shall be inspected, evaluated, and reported on in accordance with ASTM C1840, "Standard Practice for Inspection and Acceptance of Installed Reinforced Concrete Culvert, Storm Drain, and Storm Sewer Pipe." Any issues reported shall include still photo and video documentation. The zoom ratio shall be provided for all still or video images that document any issues of concern by the inspection firm.

METHOD OF MEASUREMENT

701-4.1 The length of pipe shall be measured in linear feet of pipe in place, completed, and accepted. It shall be measured along the centerline of the pipe from end or inside face of structure to the end or inside face of structure, whichever is applicable.

BASIS OF PAYMENT

701-5.0 These prices shall fully compensate the Contractor for the furnishing of all materials and for all preparation, excavation, and installation of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

701-5.1 Payment will be made at the contract unit price per linear foot for 15" RC Pipe per Class, as shown on the plans.

Payment will be made under:

Item 701-5.1 15" RC Pipe Class III - per Linear Foot

Item 701-5.2 15” RC Pipe Class IV - per Linear Foot

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C94	Standard Specification for Ready Mixed Concrete
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D3282	Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

National Fire Protection Association (NFPA)

NFPA 415	Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways

END ITEM D-701

ITEM D-751

MANHOLES, CATCH BASINS, INLETS, AND INSPECTION HOLES

DESCRIPTION

751-1.1 This item shall consist of construction of catch basins and inlets in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the ENGINEER.

MATERIALS

751-2.1 Brick. The brick shall conform to the requirements of ASTM C32, Grade MS.

751-2.2 Mortar. Mortar shall consist of one part Portland cement and two parts sand. The cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

751-2.3 Concrete. Plain and reinforced concrete used in structures, connections of pipes with structures, and the support of structures or frames shall conform to the requirements of Item P-610.

751-2.4 Precast Concrete Pipe Manhole Rings. Precast concrete pipe manhole rings shall conform to the requirements of ASTM C478. Unless otherwise specified, the risers and offset cone sections shall have an inside diameter of not less than 36 inches nor more than 48 inches. There shall be a gasket between individual sections and sections cemented together with mortar on the inside of the manhole. Gaskets shall conform to the requirements of ASTM C443.

751-2.5 Corrugated Metal. Not Used.

751-2.6 Frames, Covers, and Grates. The castings shall conform to one of the following requirements:

A. ASTM A48, Class 35B: Gray iron castings.

B. ASTM A47: Malleable iron castings.

C. ASTM A27: Steel castings.

D. ASTM A283, Grade D: Structural steel for grates and frames.

E. ASTM A536, Grade 65-45-12: Ductile iron castings.

F. ASTM A897: Austempered ductile iron castings.

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings, aircraft gear configuration and/or direct loading, specified.

Each frame and cover or grate unit shall be provided with fastening members to prevent it from being dislodged by traffic, but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A123.

751-2.7 Steps. The steps or ladder bars shall be gray or malleable cast iron or galvanized steel. The steps shall be the size, length, and shape shown on the plans and those steps that are not galvanized shall be given a coat of asphalt paint, when directed.

751-2.8 Precast Inlet Structures. Manufactured in accordance with and conforming to ASTM C913

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CONSTRUCTION METHODS

751-3.1 Unclassified Excavation.

A. The Contractor shall excavate for structures and footings to the lines and grades or elevations, shown on the plans, or as staked by the Contractor. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximately only; and the ENGINEER may direct, in writing, changes in dimensions or elevations of footings necessary for a satisfactory foundation.

B. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the ENGINEER. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. Where concrete will rest on a surface other than rock, the bottom of the excavation shall not be disturbed and excavation to final grade shall not be made until immediately before the concrete or reinforcing is placed.

C. The Contractor shall do all bracing, sheathing, or shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for the structure.

D. All bracing, sheathing, or shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall not disturb, or damage finished masonry. The cost of removal shall be included in the unit price bid for the structure.

E. After excavation is completed for each structure, the Contractor shall notify the ENGINEER. No concrete or reinforcing steel shall be placed until the ENGINEER has approved the depth of the excavation and the character of the foundation material.

751-3.2 Brick Structures. Not Used.

751-3.3 Concrete Structures. Concrete structures which are to be cast-in-place within the project boundaries shall be built on prepared foundations, conforming to the dimensions and shape indicated on the plans. The construction shall conform to the requirements specified in Item P-610. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the ENGINEER before the concrete is placed.

All invert channels shall be constructed and shaped accurately to be smooth, uniform, and cause minimum resistance to flowing water. The interior bottom shall be sloped to the outlet.

751-3.4 Precast Concrete Structures. Precast concrete structures shall be furnished by a plant meeting National Precast Concrete Association Plant Certification Program or American Concrete Pipe Association QCast Plant Certification program.

Precast concrete structures shall conform to ASTM C478. Precast concrete structures shall be constructed on prepared or previously placed slab foundations conforming to the dimensions and locations shown on the plans. All precast concrete sections necessary to build a completed structure shall be furnished. The different sections shall fit together readily. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall: (1) be smoothed to a uniform surface on both interior and exterior of the structure or (2) utilize a rubber gasket per ASTM C443. The top of the upper precast concrete section shall be suitably formed and dimensioned to receive the metal frame and cover or grate, or other cap, as required. Provision shall be made for any connections for lateral pipe, including drops and leads that may be installed in the structure. The flow lines shall be smooth, uniform, and cause minimum resistance to flow. The metal or metal encapsulated steps that are embedded or built into the side walls shall be aligned and placed in accordance with ASTM C478. When a metal ladder replaces the steps, it shall be securely fastened into position.

751-3.5 Corrugated Metal Structures. Not Used.

751-3.6 Inlet and Outlet Pipes. Inlet and outlet pipes shall extend through the walls of the structures a sufficient distance beyond the outside surface to allow for connections. They shall be cut off flush with the wall on the inside surface of the structure, unless otherwise directed. For concrete or brick structures, mortar shall be placed around these pipes to form a tight, neat connection.

751-3.7 Placement and Treatment of Castings, Frames, And Fittings. All castings, frames, and fittings shall be placed in the positions indicated on the plans or as directed by the ENGINEER and shall be set true to line and elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

When frames or fittings are placed on previously constructed masonry, the bearing surface of the masonry shall be brought true to line and grade and shall present an even bearing surface so the entire face or back of the unit will come in contact with the masonry. The unit shall be set in mortar beds and anchored to the masonry as indicated on the plans or as directed by the ENGINEER. All units shall set firm and secure.

After the frames or fittings have been set in final position, the concrete or mortar shall be allowed to harden for seven (7) days before the grates or covers are placed and fastened down.

751-3.8 Installation of Steps. The steps shall be installed as indicated on the plans or as directed by the ENGINEER. When the steps are to be set in concrete, they shall be placed and secured in position before the concrete is placed. When the steps are installed in brick masonry, they shall be placed as the masonry is being built. The steps shall not be disturbed or used until the concrete or mortar has hardened for at least seven (7) days. After seven (7) days, the steps shall be cleaned and painted, unless they have been galvanized.

When steps are required with precast concrete structures they shall meet the requirements of ASTM C478. The steps shall be cast into the side of the sections at the time the sections are manufactured or set in place after the structure is erected by drilling holes in the concrete and cementing the steps in place.

When steps are required with corrugated metal structures, they shall be welded into aligned position at a vertical spacing of 12 inches.

Instead of steps, prefabricated ladders may be installed. For brick or concrete structures, the ladder shall be held in place by grouting the supports in drilled holes. For metal structures, the ladder shall be secured by welding the top

support to the structure and grouting the bottom support into drilled holes in the foundation or as directed by the ENGINEER.

751-3.9 Backfilling.

A. After a structure has been completed, the area around it shall be backfilled with approved material, in horizontal layers not to exceed 8 inches in loose depth and compacted to the density required in Item P-152. Each layer shall be deposited evenly around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the ENGINEER.

B. Backfill shall not be placed against any structure until approved by the ENGINEER. For concrete structures, approval shall not be given until the concrete has been in place seven (7) days, or until tests establish that the concrete has attained sufficient strength to withstand any pressure created by the backfill and placing methods.

C. Backfill shall not be measured for direct payment. Performance of this work shall be considered an obligation of the Contractor covered under the contract unit price for the structure involved.

751-3.10 Cleaning and Restoration of Site. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as approved by the ENGINEER. The Contractor shall restore all disturbed areas to their original condition. The Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

METHOD OF MEASUREMENT

751-4.1 Catch basins and inlets shall be measured by the unit.

BASIS OF PAYMENT

751-5.1 The accepted quantities of catch basins and inlets will be paid for at the contract unit price per each in place when completed. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials; furnishing and installation of such specials and connections to pipes and other structures as may be required to complete the item as shown on the plans; and for all labor equipment, tools and incidentals necessary to complete the structure.

Payment will be made under:

Item D-751-5.1 Concrete Drop Inlet - per Each

Item D-751-5.2 Curb Inlet - per Each

Item D-751-5.3 Concrete Drop Inlet “Doghouse” - per Each

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM A27 Standard Specification for Steel Castings, Carbon, for General Application

ASTM A47 Standard Specification for Ferritic Malleable Iron Castings

ASTM A48 Standard Specification for Gray Iron Castings

ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A283 Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

ASTM A536 Standard Specification for Ductile Iron Castings

ASTM A897 Standard Specification for Austempered Ductile Iron Castings

ASTM C144 Standard Specification for Aggregate for Masonry Mortar

ASTM C150 Standard Specification for Portland Cement

ASTM C443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

ASTM C478 Standard Specification for Precast Reinforced Concrete Manhole Sections

ASTM C913 Standard Specification for Precast Concrete Water and Wastewater Structures.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M36 Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains

END OF ITEM D-751

ITEM D-752

CONCRETE CULVERTS, HEADWALLS, AND MISCELLANEOUS DRAINAGE STRUCTURES

DESCRIPTION

752-1.1 This item shall consist of plain or reinforced concrete culverts, headwalls, and miscellaneous drainage structures constructed in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the ENGINEER.

MATERIALS

752-2.1 Concrete. Plain or Reinforced concrete shall meet the requirements of Specification P-610.

CONSTRUCTION METHODS

752-3.1 Unclassified Excavation.

A. Trenches and foundation pits for structures or structure footings shall be excavated to the lines and grades and elevations shown on the plans. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximate only; and the ENGINEER may approve, in writing, changes in dimensions or elevations of footings necessary to secure a satisfactory foundation.

B. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the ENGINEER. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. When concrete will rest on a surface other than rock, the bottom of the excavation shall not be disturbed and excavation to final grade shall not be made until immediately before the concrete or reinforcing steel is placed.

C. The Contractor shall do all bracing, sheathing, or shoring necessary to perform and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for excavation.

D. All bracing, sheathing, or shoring shall be removed by the Contractor after the completion of the structure. Removal shall not disturb or damage the

finished concrete. The cost of removal shall be included in the unit price bid for excavation.

E. After each excavation is completed, the Contractor shall notify the ENGINEER. No concrete or reinforcing steel shall be placed until the ENGINEER has approved the depth of the excavation and the character of the foundation material.

752-3.2 Backfilling.

A. After a structure has been completed, backfilling with approved material shall be accomplished by applying the fill in horizontal layers not to exceed 8 inches in loose depth, and compacted. The field density of the compacted material shall be at least 90% of the maximum density for cohesive soils and 95% of the maximum density for noncohesive soils. The maximum density shall be determined in accordance with ASTM D698. The field density shall be determined in accordance with ASTM D1556.

B. No backfilling shall be placed against any structure until approved by the ENGINEER. For concrete, approval shall not be given until the concrete has been in place seven (7) days, or until tests establish that the concrete has attained sufficient strength to withstand any pressure created by the backfill or the placement methods.

C. Fill placed around concrete culverts shall be deposited on each side at the same time and to approximately the same elevation. All slopes bounding or within the areas to be backfilled shall be stepped or serrated to prevent wedge action against the structure.

D. Backfill will not be measured for direct payment. Performance of this work shall be considered as a subsidiary obligation of the Contractor, covered under the contract unit price for “unclassified excavation for structures.”

752-3.3 Weep Holes. Weep holes shall be constructed as shown on the plans.

752-3.4 Cleaning and Restoration of Site. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site off Airport property. Surplus dirt may be deposited in embankment, shoulders, or as approved by the ENGINEER. The Contractor shall restore all disturbed areas to their original condition. The Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

METHOD OF MEASUREMENT

752-4.1 The quantity of flared end sections shall be measured on a per each basis.

BASIS OF PAYMENT

752-5.1 The accepted quantities of endwalls/flared end section will be paid for at the contract unit price per each in place when completed. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of materials; furnishing and installation of such specials and connections to pipes and other structures as may be required to complete the item as shown on the plans: and for all labor equipment, tools and incidentals necessary to complete the structure.

Payment will be made under:

Item D-752-5.1 15” RC Flared End Section - per Each

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3)

ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

END OF ITEM D-752

ITEM F-162

CHAIN-LINK FENCE

DESCRIPTION

162-1.1 This item shall consist of furnishing and erecting a chain-link fence in accordance with these specifications, the details shown on the plans, and in conformity with the lines and grades shown on the plans or established by the ENGINEER.

MATERIALS

162-2.1 Fabric. The fabric shall be woven with a 9-gauge galvanized steel wire in a 2-inch mesh and shall meet the requirements of ASTM A392, Class 2

162-2.2 Barbed Wire. Barbed wire shall be 2-strand 12-1/2-gauge zinc-coated wire with 4-point barbs and shall conform to the requirements of ASTM A121, Class 3, Chain Link Fence Grade.

162-2.3 Posts, Rails, and Braces. Line posts, rails, and braces shall conform to the requirements of ASTM F1043 or ASTM F1083 as follows:

- Galvanized tubular steel pipe shall conform to the requirements of Group IA, (Schedule 40) coatings conforming to Type A, or Group IC (High Strength Pipe), External coating Type B, and internal coating Type B or D.

Posts, rails, and braces, with the exception of galvanized steel conforming to ASTM F1043 or ASTM F1083, Group 1A, Type A, or aluminum alloy, shall demonstrate the ability to withstand testing in salt spray in accordance with ASTM B117 as follows:

External: 1,000 hours with a maximum of 5% red rust.

Internal: 650 hours with a maximum of 5% red rust.

The dimensions of the posts, rails, and braces shall be in accordance with Tables I through VI of Federal Specification RR-F-191/3.

162-2.4 Gates. Gate frames shall consist of galvanized steel pipe and shall conform to the specifications for the same material under Paragraph 162-2.3. The fabric shall be of the same type material as used in the fence.

162-2.5 Wire Ties and Tension Wires. Wire ties for use in conjunction with a given type of fabric shall be of the same material and coating weight identified with

the fabric type. Tension wire shall be 7-gauge marcelled steel wire with the same coating as the fabric type and shall conform to ASTM A824.

All material shall conform to Federal Specification RR-F-191/4.

162-2.6 Miscellaneous Fittings and Hardware. Miscellaneous steel fittings and hardware for use with zinc-coated steel fabric shall be of commercial grade steel or better quality, wrought or cast as appropriate to the article, and sufficient in strength to provide a balanced design when used in conjunction with fabric posts, and wires of the quality specified herein. All steel fittings and hardware shall be protected with a zinc coating applied in conformance with ASTM A153. Barbed wire support arms shall withstand a load of 250 pounds applied vertically to the outermost end of the arm.

162-2.7 Concrete. Concrete shall have a minimum 28-day compressive strength of 3000 psi and shall be an accordance with requirements of Specification P-610.

162-2.8 Marking. Each roll of fabric shall carry a tag showing the kind of base metal (steel, aluminum, or aluminum alloy number), kind of coating, the gauge of the wire, the length of fencing in the roll, and the name of the Manufacturer. Posts, wire, and other fittings shall be identified as to Manufacturer, kind of base metal (steel, aluminum, or aluminum alloy number), and kind of coating.

CONSTRUCTION METHODS

162-3.1 General. The fence shall be constructed in accordance with the details on the plans and as specified here using new materials. All work shall be performed in a workmanlike manner satisfactory to the ENGINEER. The Contractor shall layout the fence line based on the plans. The Contractor shall span the opening below the fence with barbed wire at all locations where it is not practical to conform the fence to the general contour of the ground surface because of natural or manmade features such as drainage ditches. The new fence shall be permanently tied to the terminals of existing fences as shown on the plans. The Contractor shall stake down the woven wire fence at several points between posts as shown on the plans.

The Contractor shall arrange the work so that construction of the new fence will immediately follow the removal of existing fences. The length of unfenced section at any time shall not exceed 300 feet. The work shall progress in this manner and at the close of the working day the newly constructed fence shall be tied to the existing fence.

162-3.2 Clearing Fence Line. Not Used.

162-3.3 Installing Posts. All posts shall be set in concrete at the required dimension and depth and at the spacing shown on the plans.

The concrete shall be thoroughly compacted around the posts by tamping or vibrating and shall have a smooth finish slightly higher than the ground and sloped to drain away from the posts. All posts shall be set plumb and to the required grade and alignment. **No materials shall be installed on the posts, nor shall the posts be disturbed in any manner within seven (7) days after the individual post footing is completed.**

Should rock be encountered at a depth less than the planned footing depth, a hole 2 inches larger than the greatest dimension of the posts shall be drilled to a depth of 12 inches . After the posts are set, the remainder of the drilled hole shall be filled with grout, composed of one-part Portland cement and two parts mortar sand. Any remaining space above the rock shall be filled with concrete in the manner described above.

In lieu of drilling, the rock may be excavated to the required footing depth. No extra compensation shall be made for rock excavation.

162-3.4 Installing Top Rails. The top rail shall be continuous and shall pass through the post tops. The coupling used to join the top rail lengths shall allow for expansion.

162-3.5 Installing Braces. Horizontal brace rails, with diagonal truss rods and turnbuckles, shall be installed at all terminal posts.

162-3.6 Installing Fabric. The wire fabric shall be firmly attached to the posts and braced as shown on the plans. All wire shall be stretched taut and shall be installed to the required elevations. The fence shall generally follow the contour of the ground, with the bottom of the fence fabric no less than one inch or more than 4 inches from the ground surface. Grading shall be performed where necessary to provide a neat appearance.

At locations of small natural swales or drainage ditches and where it is not practical to have the fence conform to the general contour of the ground surface, longer posts may be used and multiple strands of barbed wire stretched to span the opening below the fence. The vertical clearance between strands of barbed wire shall be 6 inches or less.

162-3.7 Electrical Grounds. Electrical grounds shall be constructed where a power line passes over the fence and at 500 feet intervals. The ground shall be installed directly below the point of crossing. The ground shall be accomplished with a copper clad rod 8 feet long and a minimum of 5/8 inches in diameter driven vertically until the top is 6 inches below the ground surface. A No. 6 solid copper conductor shall be clamped to the rod and to the fence in such a manner that each element of the fence is grounded. Installation of ground rods shall not constitute a pay item and shall be considered incidental to fence

construction. The Contractor shall comply with FAA-STD-019, Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment, Paragraph 4.2.3.8, Lightning Protection for Fences and Gates, when fencing is adjacent to FAA facilities.

162-3.8 Cleaning Up. The Contractor shall remove from the vicinity of the completed work all tools, buildings, equipment, etc., used during construction. All disturbed areas shall be seeded per Specification T-901.

METHOD OF MEASUREMENT

162-4.1 Fence removal will be measured for payment by the linear foot, regardless of the type of fence being removed and offsite disposal of materials removed. Measurement will be along the top of the fence from center to center of end posts.

162-4.2 Chain-link fence will be measured for payment by the linear foot. Measurement will be along the top of the fence from center to center of end posts, excluding the length occupied by gate openings.

162-4.3 Gates will be measured as complete units.

BASIS OF PAYMENT

162-5.1 Payment for Fence Removal will be made at the contract unit price per linear foot. The price shall be full compensation for furnishing all materials, and for all work necessary to completely remove the existing chain link fence, including concrete fence post foundations and for all backfill and grading needed to fill the holes remaining from the fence removal operations.

162-5.2 Payment for chain-link fence will be made at the contract unit price per linear foot .

162-5.3 Payment for pedestrian gates will be made at the contract unit price for each gate.

The price shall be full compensation for furnishing all materials, and for all preparation, erection, and installation of these materials, and for all labor equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item F-162-5.1 6’ Chain-Link Fence Removal – per Linear Foot

Item F-162-5.2 6’ Chain-Link Fence with 3 Strand Barbed Wire – per Linear Foot

Item F-162-5.3 5’-0” Pedestrian Gate - per Each

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM A121 Standard Specification for Metallic-Coated Carbon Steel Barbed Wire

ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A392 Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric

ASTM A824 Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence

ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM F1043 Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework

ASTM F1083 Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

ASTM F1345 Standard Specification for Zinc 5% Aluminum-Mischmetal Alloy Coated Steel Chain-Link Fence Fabric

ASTM G152 Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

ASTM G153 Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

ASTM G154 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

ASTM G155 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials

Federal Specifications (FED SPEC)

FED SPEC RR-F-191/3	Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)
FED SPEC RR-F-191/4	Fencing, Wire and Post, Metal (Chain-Link Fence Accessories)

FAA Standard

FAA-STD-019	Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment

FAA Orders

5300.38 AIP Handbook

END OF ITEM F-162

ITEM T-901

SEEDING

DESCRIPTION

901-1.1 This item shall consist of soil preparation, seeding, fertilizing, and liming the areas shown on the plans or as directed by the ENGINEER in accordance with these specifications.

MATERIALS

901-2.1 **Seed.** The species and application rates of grass, legume, and cover-crop seed furnished shall be those stipulated herein. Seed shall conform to the requirements of Federal Specification JJJ-S-181, Federal Specification, Seeds, Agricultural.

Seed shall be furnished separately or in mixtures in standard containers labeled in conformance with the Agricultural Marketing Service (AMS) Seed Act and applicable state seed laws with the seed name, lot number, net weight, percentages of purity and of germination and hard seed, and percentage of maximum weed seed content clearly marked for each kind of seed. The Contractor shall furnish the ENGINEER duplicate signed copies of a statement by the vendor certifying that each lot of seed has been tested by a recognized laboratory for seed testing within six (6) months of date of delivery. This statement shall include: name and address of laboratory, date of test, lot number for each kind of seed, and the results of tests as to name, percentages of purity and of germination, and percentage of weed content for each kind of seed furnished, and, in case of a mixture, the proportions of each kind of seed. Wet, moldy, or otherwise damaged seed will be rejected.

Seeds shall be applied as follows:

Permanent Seeding

Seeding Mixture	Rate of Application (lb/acre)	Planting Dates
Common Bermudagrass (Hulled)	50	March 1 - August 31
Common Bermudagrass (Unhulled)	70	September 1 – February 28

Temporary Seeding

Rye (Grain) Kobe Lespedeza	120 50	December 1 – April 15
Hulled Bermudagrass	50	April 16 – August 31
Rye (Grain)	120	September 1 – December 31

Seeding shall be performed during the periods as specified above, unless otherwise approved by the ENGINEER.

901-2.2 Lime. Lime shall be ground limestone containing not less than 85% of total carbonates and shall be ground to such fineness that 90% will pass through a No. 20 mesh sieve and 50% will pass through a No. 100 mesh sieve. Coarser material will be acceptable, providing the rates of application are increased to provide not less than the minimum quantities and depth specified in the special provisions on the basis of the two sieve requirements above. Dolomitic lime or a high magnesium lime shall contain at least 10% of magnesium oxide. Lime shall be applied at the rate of 3,000 lbs/acre. All liming materials shall conform to the requirements of ASTM C602.

901-2.3 Fertilizer. Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate and to the depth specified and shall meet the requirements of applicable state laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

A. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader; or

B. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or

C. A granular or pellet form suitable for application by blower equipment.

Fertilizers shall be 10-10-10 commercial fertilizer and shall be spread at the rate of 500 pounds per acre.

901-2.4 Soil for Repairs. The soil for fill and topsoiling of areas to be repaired shall be at least of equal quality to that which exists in areas adjacent to the area to be repaired. The soil shall be relatively free from large stones, roots, stumps, or other materials that will interfere with subsequent sowing of seed, compacting, and establishing turf, and shall be approved by the ENGINEER before being placed.

CONSTRUCTION METHODS

901-3.1 Advance Preparation and Cleanup. After grading of areas has been completed and before applying fertilizer and ground limestone, areas to be seeded shall be raked or otherwise cleared of stones larger than 2 inches in

any diameter, sticks, stumps, and other debris that might interfere with sowing of seed, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes has occurred after the completion of grading and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage include filling gullies, smoothing irregularities, and repairing other incidental damage.

An area to be seeded shall be considered a satisfactory seedbed without additional treatment if it has recently been thoroughly loosened and worked to a depth of not less than 5 inches as a result of grading operations and, if immediately prior to seeding, the top 3 inches of soil is loose, friable, reasonably free from large clods, rocks, large roots, or other undesirable matter, and if shaped to the required grade.

When the area to be seeded is sparsely sodded, weedy, barren, and unworked, or packed and hard, any grass and weeds shall first be cut or otherwise satisfactorily disposed of, and the soil then scarified or otherwise loosened to a depth not less than 5 inches. Clods shall be broken, and the top 3 inches of soil shall be worked into a satisfactory seedbed by discing, or by use of cultipackers, rollers, drags, harrows, or other appropriate means.

901-3.2 Dry Application Method.

A. Liming. Lime shall be applied separately and prior to the application of any fertilizer or seed and only on seedbeds that have previously been prepared as described above. The lime shall then be worked into the top 3 inches of soil after which the seedbed shall again be properly graded and dressed to a smooth finish.

B. Fertilizing. Following advance preparations and cleanup fertilizer shall be uniformly spread at the rate that will provide not less than the minimum quantity stated in Paragraph 901-2.3.

C. Seeding. Grass seed shall be sown at the rate specified in Paragraph 901-2.1 immediately after fertilizing. The fertilizer and seed shall be raked within the depth range stated in the special provisions. Seeds of legumes, either alone or in mixtures, shall be inoculated before mixing or sowing, in accordance with the instructions of the Manufacturer of the inoculant. When seeding is required at other than the seasons shown on the plans or in the special provisions, a cover crop shall be sown by the same methods required for grass and legume seeding.

D. Rolling. After the seed has been properly covered, the seedbed shall be immediately compacted by means of an approved lawn roller, weighing 40 to 65 pounds per foot of width for clay soil (or any soil having a tendency to pack), and weighing 150 to 200 pounds per foot of width for sandy or light soils.

901-3.3 Wet Application Method.

A. General. The Contractor may elect to apply seed and fertilizer (and lime, if required) by spraying them on the previously prepared seedbed in the form of an aqueous mixture and by using the methods and equipment described herein. The rates of application shall be as specified in the special provisions.

B. Spraying Equipment. The spraying equipment shall have a container or water tank equipped with a liquid level gauge calibrated to read in increments not larger than 50 gallons over the entire range of the tank capacity, mounted so as to be visible to the nozzle operator. The container or tank shall also be equipped with a mechanical power-driven agitator capable of keeping all the solids in the mixture in complete suspension at all times until used.

The unit shall also be equipped with a pressure pump capable of delivering 100 gallons per minute at a pressure of 100 pounds / square inch. The pump shall be mounted in a line that will recirculate the mixture through the tank whenever it is not being sprayed from the nozzle. All pump passages and pipelines shall be capable of providing clearance for 5/8 inch solids. The power unit for the pump and agitator shall have controls mounted so as to be accessible to the nozzle operator. There shall be an indicating pressure gauge connected and mounted immediately at the back of the nozzle.

The nozzle pipe shall be mounted on an elevated supporting stand in such a manner that it can be rotated through 360 degrees horizontally and inclined vertically from at least 20 degrees below to at least 60 degrees above the horizontal. There shall be a quick-acting, three-way control valve connecting the recirculating line to the nozzle pipe and mounted so that the nozzle operator can control and regulate the amount of flow of mixture delivered to the nozzle. At least three different types of nozzles shall be supplied so that mixtures may be properly sprayed over distance varying from 20 to 100 feet. One shall be a close-range ribbon nozzle, one a medium-range ribbon nozzle, and one a long-range jet nozzle. For case of removal and cleaning, all nozzles shall be connected to the nozzle pipe by means of quick-release couplings.

In order to reach areas inaccessible to the regular equipment, an extension hose at least 50 feet in length shall be provided to which the nozzles may be connected.

C. Mixtures. Lime, if required, shall be applied separately, in the quantity specified, prior to the fertilizing and seeding operations. Not more than 220 pounds of lime shall be added to and mixed with each 100 gallons of water. Seed and fertilizer shall be mixed together in the relative proportions specified, but not more than a total of 220 pounds of these combined solids shall be added to and mixed with each 100 gallons of water.

All water used shall be obtained from fresh water sources and shall be free from injurious chemicals and other toxic substances harmful to plant life. The Contractor shall identify to the ENGINEER all sources of water at least two (2) weeks prior to use. The RPR/ENGINEER may take samples of the water at the source or from the tank at any time and have a laboratory test the samples for chemical and saline content. The Contractor shall not use any water from any source that is disapproved by the ENGINEER following such tests.

All mixtures shall be constantly agitated from the time they are mixed until they are finally applied to the seedbed. All such mixtures shall be used within two (2) hours from the time they were mixed, or they shall be wasted and disposed of at approved locations.

D. Spraying. Lime, if required, shall be sprayed only upon previously prepared seedbeds. After the applied lime mixture has dried, the lime shall be worked into the top 3 inches, after which the seedbed shall again be properly graded and dressed to a smooth finish.

Mixtures of seed and fertilizer shall only be sprayed upon previously prepared seedbeds on which the lime, if required, shall already have been worked in. The mixtures shall be applied by means of a high-pressure spray that shall always be directed upward into the air so that the mixtures will fall to the ground like rain in a uniform spray. Nozzles or sprays shall never be directed toward the ground in such a manner as might produce erosion or runoff.

Particular care shall be exercised to ensure that the application is made uniformly and at the prescribed rate and to guard against misses and overlapped areas. Proper predetermined quantities of the mixture in accordance with specifications shall be used to cover specified sections of known area.

Checks on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets of paper or pans over the area at intervals and observing the quantity of material deposited thereon.

On surfaces that are to be mulched as indicated by the plans or designated by the ENGINEER, seed and fertilizer applied by the spray method need not be raked into the soil or rolled. However, on surfaces on which mulch is not to be used, the raking and rolling operations will be required after the soil has dried.

901-3.4 Maintenance of Seeded Areas. The Contractor shall protect seeded areas against traffic or other use by warning signs or barricades, as approved by the ENGINEER. Surfaces gullied or otherwise damaged following seeding shall be repaired by regrading and reseeding as directed. The Contractor shall mow,

water as directed, and otherwise maintain seeded areas in a satisfactory condition until final inspection and acceptance of the work.

When either the dry or wet application method outlined above is used for work done out of season, it will be required that the Contractor establish a good stand of grass of uniform color and density to the satisfaction of the ENGINEER. A grass stand shall be considered adequate when bare spots are one square foot or less, randomly dispersed, and do not exceed 3% of the area seeded.

METHOD OF MEASUREMENT

901-4.1 The quantity of seeding to be paid for shall be the number of units per acre measured on the ground surface, completed, and accepted.

901-4.2 The quantity of Watering to be paid for will be the actual number of 1,000 gallon units of water, up to the quantity shown in the contract documents, which have been satisfactorily and uniformly applied to the site. Any amount of water that may be needed beyond the contract quantity will be performed by the Contractor at his expense. The OWNER will not pay for any quantity of water greater than he quantity in the contract. Measurement of water will be made by means of determining the volumetric capacity of the tanks/trucks used to deliver water to the project and recording the number of loads delivered by each truck. The Contractor will ensure the quantity of each tank/truck of water is verified and recorded by the on-site Resident Project Representative or the OWNER's designated representative. Failure to obtain verification and recording of the volume of each tank/truck shall to sufficient grounds for the OWNER to disallow payment.

BASIS OF PAYMENT

901-5.1 Payment shall be made at the contract unit price per acre or fraction thereof, which price and payment shall be full compensation for furnishing and placing all material and for all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item.

901-5.2 Payment for Watering shall be made at the contract unit price per 1,000 gallons or fraction thereof, which price and payment shall be full compensation for furnishing and applying all water and for all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item.

Payment will be made under:

Item 901-5.1 Seeding – per Acre

Item 910-5.2 Watering – per 1,000 gallons

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM C602 Standard Specification for Agricultural Liming Materials

Federal Specifications (FED SPEC)

FED SPEC JJJ-S-181, Federal Specification, Seeds, Agricultural

Advisory Circulars (AC)

AC 150/5200-33C Hazardous Wildlife Attractants on or Near Airports

FAA/United States Department of Agriculture

Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM T-901

ITEM T-904

SODDING

DESCRIPTION

904-1.1 This item shall consist of furnishing, hauling, and placing approved live sod on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the ENGINEER.

MATERIALS

904-2.1 **Sod.** Sod furnished by the Contractor shall have a good cover of living or growing grass. This shall be interpreted to include grass that is seasonally dormant during the cold or dry seasons and capable of renewing growth after the dormant period. All sod shall be obtained from areas where the soil is reasonably fertile and contains a high percentage of loamy topsoil. Sod shall be cut or stripped from living, thickly matted turf relatively free of weeds or other undesirable foreign plants, large stones, roots, or other materials that might be detrimental to the development of the sod or to future maintenance. At least 70% of the plants in the cut sod shall be composed of the species stated in the special provisions, and any vegetation more than 6 inches in height shall be mowed to a height of 3 inches or less before sod is lifted. Sod, including the soil containing the roots and the plant growth showing above, shall be cut uniformly to a thickness not less than that stated in the special provisions. Sod shall be cut uniformly to a thickness not less than that stated in the special provisions.

904-2.2 **Lime.** Lime shall be ground limestone containing not less than 85% of total carbonates and shall be ground to such fineness that 90% will pass through a No. 20 mesh sieve and 50% will pass through a No. 100 mesh sieve. Coarser material will be acceptable, providing the rates of application are increased to provide not less than the minimum quantities and depth specified in the special provisions on the basis of the two sieve requirements above. Dolomitic lime or a high magnesium lime shall contain at least 10% of magnesium oxide. Lime shall be applied at the rate of 3,000 lbs/acre**.**

904-2.3 **Fertilizer.** Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate and to the depth specified and shall meet the requirements of applicable state laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

A. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader; or

B. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or

C. A granular or pellet form suitable for application by blower equipment.

Fertilizers shall be 10-10-10 commercial fertilizer and shall be spread at the rate of 500 lbs/acre.

904-2.4 Water. The water shall be sufficiently free from oil, acid, alkali, salt, or other harmful materials that would inhibit the growth of grass.

904-2.5 Soil for Repairs. The soil for fill and topsoiling of areas to be repaired shall be at least of equal quality to that which exists in areas adjacent to the area to be repaired. The soil shall be relatively free from large stones, roots, stumps, or other materials that will interfere with subsequent sowing of seed, compacting, and establishing turf, and shall be approved by the ENGINEER before being placed.

CONSTRUCTION METHODS

904-3.1 General. Areas to be solid, strip, or spot sodded shall be shown on the plans. Areas requiring special ground surface preparation such as tilling and those areas in a satisfactory condition that are to remain undisturbed shall also be shown on the plans.

Suitable equipment necessary for proper preparation of the ground surface and for the handling and placing of all required materials shall be on hand, in good condition, and shall be approved by the ENGINEER before the various operations are started. The Contractor shall demonstrate to the RPR/ENGINEER before starting the various operations that the application of required materials will be made at the specified rates.

904-3.2 Preparing the Ground Surface. After grading of areas has been completed and before applying fertilizer and limestone, areas to be sodded shall be raked or otherwise cleared of stones larger than 2 inches in any diameter, sticks, stumps, and other debris which might interfere with sodding, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes occurs after grading of areas and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage. This may include filling gullies, smoothing irregularities, and repairing other incidental damage.

904-3.3 Applying Fertilizer and Ground Limestone. Following ground surface preparation, fertilizer shall be uniformly spread at a rate which will provide not less than the minimum quantity of each fertilizer ingredient, as stated in the special provisions. If use of ground limestone is required, it shall then be spread at a rate that will provide not less than the minimum quantity stated in the special provisions. These materials shall be incorporated into the soil to a depth of not less than 2 inches by discing, raking, or other suitable methods. Any stones larger than 2 inches in any diameter, large clods, roots, and other litter brought to the surface by this operation shall be removed.

904-3.4 Obtaining and Delivering Sod. After inspection and approval of the source of sod by the ENGINEER, the sod shall be cut with approved sod cutters to such a thickness that after it has been transported and placed on the prepared bed, but before it has been compacted, it shall have a uniform thickness of not less than 2 inches. Sod sections or strips shall be cut in uniform widths, not less than 10 inches, and in lengths of not less than 18 inches, but of such length as may be readily lifted without breaking, tearing, or loss of soil. Where strips are required, the sod must be rolled without damage with the grass folded inside. The Contractor may be required to mow high grass before cutting sod.

The sod shall be transplanted within 24 hours from the time it is stripped unless circumstances beyond the Contractor's control make storing necessary. In such cases, sod shall be stacked, kept moist, and protected from exposure to the air and sun and shall be kept from freezing. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected. Where the soil is too dry, approval to cut sod may be granted only after it has been watered sufficiently to moisten the soil to the depth the sod is to be cut.

904-3.5 Laying Sod. Sodding shall be performed only during the seasons when satisfactory results can be expected. Frozen sod shall not be used, and sod shall not be placed upon frozen soil. Sod may be transplanted during periods of drought with the approval of the ENGINEER, provided the sod bed is watered to moisten the soil to a depth of at least 4 inches immediately prior to laying the sod.

The sod shall be moist and shall be placed on a moist earth bed. Pitch forks shall not be used to handle sod and dumping from vehicles shall not be permitted. The sod shall be carefully placed by hand, edge to edge and with staggered joints, in rows at right angles to the slopes, commencing at the base of the area to be sodded and working upward. The sod shall immediately be pressed firmly into contact with the sod bed by tamping or rolling with approved equipment to provide a true and even surface and ensure knitting without displacement of the sod or deformation of the surfaces of sodded areas. Where the sod may be displaced during sodding operations, the workmen, when replacing it, shall work from ladders or treaded planks to prevent further

displacement. Screened soil of good quality shall be used to fill all cracks between sods. The quantity of the fill soil shall not cause smothering of the grass. Where the grades are such that the flow of water will be from paved surfaces across sodded areas, the surface of the soil in the sod after compaction shall be set approximately one inch below the pavement edge. Where the flow will be over the sodded areas and onto the paved surfaces around manholes and inlets, the surface of the soil in the sod after compaction shall be placed flush with pavement edges.

On slopes steeper than one (1) vertical to 2-1/2 horizontal and in v-shaped or flat-bottom ditches or gutters, the sod shall be pegged with wooden pegs not less than 12 inches in length and have a cross-sectional area of not less than 3/4 square inch. The pegs shall be driven flush with the surface of the sod.

904-3.6 Watering. Adequate water and watering equipment must be on hand before sodding begins, and sod shall be kept moist until it has become established and its continued growth assured. In all cases, watering shall be done in a manner that will avoid erosion from the application of excessive quantities and will avoid damage to the finished surface.

904-3.7 Establishing Turf. The Contractor shall provide general care for the sodded areas as soon as the sod has been laid and shall continue until final inspection and acceptance of the work. All sodded areas shall be protected against traffic or other use by warning signs or barricades approved by the ENGINEER. The Contractor shall mow the sodded areas with approved mowing equipment, depending upon climatic and growth conditions and the needs for mowing specific areas. Weeds or other undesirable vegetation shall be mowed, and the clippings raked and removed from the area.

904-3.8 Repairing. When the surface has become gullied or otherwise damaged during the period covered by this contract, the affected areas shall be repaired to re-establish the grade and the condition of the soil, as directed by the ENGINEER, and shall then be sodded as specified in Paragraph 904-3.5.

METHOD OF MEASUREMENT

904-4.1 This item shall be measured on the basis of the area in square yards of the surface covered with sod and accepted.

BASIS OF PAYMENT

904-5.1 This item will be paid for on the basis of the contract unit price per square yard for sodding, which price shall be full compensation for all labor, equipment, material, staking, and incidentals necessary to satisfactorily complete the items as specified.

Payment will be made under:

Item T-904-5.1 Sodding (Bermuda) - per Square Yard

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM C602	Standard Specification for Agricultural Liming Materials

Advisory Circulars (AC)

AC 150/5200-33C	Hazardous Wildlife Attractants on or Near Airports

FAA/United States Department of Agriculture

Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM T-904

ITEM T-905

TOPSOIL

DESCRIPTION

905-1.1 This item shall consist of preparing the ground surface for topsoil application, removing topsoil from designated stockpiles or areas to be stripped on the site or from approved sources off the site, and placing and spreading the topsoil on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the ENGINEER.

MATERIALS

905-2.1 **Topsoil.** Topsoil shall be the surface layer of soil with no admixture of refuse or any material toxic to plant growth, and it shall be reasonably free from subsoil and stumps, roots, brush, stones (2 inches or more in diameter), and clay lumps or similar objects. Brush and other vegetation that will not be incorporated with the soil during handling operations shall be cut and removed. Ordinary sod and herbaceous growth such as grass and weeds are not to be removed but shall be thoroughly broken up and intermixed with the soil during handling operations. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means, shall be removed. The topsoil or soil mixture, unless otherwise specified or approved, shall have a pH range of approximately 5.5 pH to 7.6 pH, when tested in accordance with the methods of testing of the Association of Official Agricultural Chemists in effect on the date of invitation of bids. The organic content shall be not less than 3% nor more than 20% as determined by the wet-combustion method (chromic acid reduction). There shall be not less than 20% nor more than 80% of the material passing the 200 mesh sieve as determined by the wash test in accordance with ASTM C117.

Natural topsoil may be amended by the Contractor with approved materials and methods to meet the above specifications.

905-2.2 **Inspection and Tests.** Within 10 days following acceptance of the bid, the ENGINEER shall be notified of the source of topsoil to be furnished by the Contractor. The topsoil shall be inspected to determine if the selected soil meets the requirements specified and to determine the depth to which stripping will be permitted. At this time, the Contractor may be required to take representative soil samples from several locations within the area under consideration and to the proposed stripping depths, for testing purposes as specified in Paragraph 905-2.1.

CONSTRUCTION METHODS

905-3.1 General. Areas to be topsoiled shall be shown on the plans. If topsoil is available on the site, the location of the stockpiles or areas to be stripped of topsoil and the stripping depths shall be shown on the plans.

Suitable equipment necessary for proper preparation and treatment of the ground surface, stripping of topsoil, and for the handling and placing of all required materials shall be on hand, in good condition, and approved by the ENGINEER before the various operations are started.

905-3.2 Preparing the Ground Surface. Immediately prior to dumping and spreading the topsoil on any area, the surface shall be loosened by discs or spike-tooth harrows, or by other means approved by the ENGINEER, to a minimum depth of 2 inches to facilitate bonding of the topsoil to the covered subgrade soil. The surface of the area to be topsoiled shall be cleared of all stones larger than 2 inches in any diameter and all litter or other material which may be detrimental to proper bonding, the rise of capillary moisture, or the proper growth of the desired planting. Limited areas, as shown on the plans, which are too compact to respond to these operations shall receive special scarification.

Grades on the area to be topsoiled, which have been established by others as shown on the plans, shall be maintained in a true and even condition. Where grades have not been established, the areas shall be smooth-graded and the surface left at the prescribed grades in an even and compacted condition to prevent the formation of low places or pockets where water will stand.

905-3.3 Obtaining Topsoil. Prior to the stripping of topsoil from designated areas, any vegetation, briars, stumps and large roots, rubbish or stones found on such areas, which may interfere with subsequent operations, shall be removed using methods approved by the ENGINEER. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means shall be removed.

When suitable topsoil is available on the site, the Contractor shall remove this material from the designated areas and to the depth as directed by the ENGINEER. The topsoil shall be spread on areas already tilled and smooth-graded or stockpiled in areas approved by the ENGINEER. Any topsoil stockpiled by the Contractor shall be rehandled and placed without additional compensation. Any topsoil that has been stockpiled on the site by others, and is required for topsoil purposes, shall be removed, and placed by the Contractor. The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor shall be graded if required and put into a condition acceptable for seeding.

When suitable topsoil is secured off the Airport site, the Contractor shall locate and obtain the supply, subject to the approval of the ENGINEER. The

Contractor shall notify the ENGINEER sufficiently in advance of operations in order that necessary measurements and tests can be made. The Contractor shall remove the topsoil from approved areas and to the depth as directed. The topsoil shall be hauled to the site of the work and placed for spreading or spread as required. Any topsoil hauled to the site of the work and stockpiled shall be rehandled and placed without additional compensation.

905-3.4 Placing Topsoil. The topsoil shall be evenly spread on the prepared areas to a uniform depth of 2 inches after compaction, unless otherwise shown on the plans or stated in the special provisions. Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Spreading shall be carried on so that turfing operations can proceed with a minimum of soil preparation or tilling.

After spreading, any large, stiff clods and hard lumps shall be broken with a pulverizer or by other effective means, and all stones or rocks (2 inches or more in diameter), roots, litter, or any foreign matter shall be raked up and disposed of by the Contractor. after spreading is completed, the topsoil shall be satisfactorily compacted by rolling with a cultipacker or by other means approved by the ENGINEER. The compacted topsoil surface shall conform to the required lines, grades, and cross-sections. Any topsoil or other dirt falling upon pavements as a result of hauling or handling of topsoil shall be promptly removed.

METHOD OF MEASUREMENT

905-4.1 Topsoil obtained on the site shall be measured by the number of cubic yards of topsoil measured in its original position and stripped or excavated. Topsoil stockpiled by others and removed for topsoil by the Contractor shall be measured by the number of cubic yards of topsoil measured in the stockpile. Topsoil shall be measured by volume in cubic yards computed by the method of end areas.

905-4.2 Topsoil obtained off the site shall be measured by the number of cubic yards of topsoil measured in its original position and stripped or excavated. Topsoil shall be measured by volume in cubic yards computed by the method of end areas.

BASIS OF PAYMENT

905-5.1 Payment will be made at the contract unit price per cubic yard for topsoil (obtained on the site). This price shall be full compensation for furnishing all materials and for all preparation, placing, and spreading of the materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

905-5.2 Payment will be made at the contract unit price per cubic yard for topsoil (obtained off the site). This price shall be full compensation for furnishing all materials and for all preparation, placing, and spreading of the materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item T-905-5.1 Topsoil (Obtained on Site or Removed from Stockpile – per Cubic Yard

Item T-905-5.2 Topsoil (Furnished from Off the Site) - per Cubic Yard

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM C117	Materials Finer than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing

Advisory Circulars (AC)

AC 150/5200-33C	Hazardous Wildlife Attractants on or Near Airports

FAA/United States Department of Agriculture

Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM T-905

ITEM T-908

MULCHING

DESCRIPTION

908-1.1 This item shall consist of furnishing, hauling, placing, and securing mulch on surfaces indicated on the plans or designated by the ENGINEER.

MATERIALS

908-2.1 Mulch Material. Acceptable mulch shall be the materials listed below or any approved locally available material that is similar to those specified. Mulch shall be free from noxious weeds, mold, and other deleterious materials. Mulch materials, which contain matured seed of species that would volunteer and be detrimental to the proposed over seeding, or to surrounding farmland, will not be acceptable. Straw or other mulch material which is fresh and/or excessively brittle, or which is in such an advanced stage of decomposition as to smother or retard the planted grass, will not be acceptable.

A. Hay. Hay shall be native hay in an air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay shall be sterile, containing no fertile seed.

B. Straw. Straw shall be the stalks from threshed plant residue of oats, wheat, barley, rye, or rice from which grain has been removed. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

C. Hay Mulch Containing Seed. Hay mulch shall be mature hay containing viable seed of native grasses or other desirable species stated in the special provisions or as approved by the ENGINEER. The hay shall be cut and handled so as to preserve the maximum quantity of viable seed. Hay mulch that cannot be hauled and spread immediately after cutting shall be placed in weather-resistant stacks or baled and stored in a dry location until used.

D. Manufactured Mulch. Cellulose-fiber or wood-pulp mulch shall be products commercially available for use in spray applications.

E. Asphalt Binder. Asphalt binder material shall conform to the requirements of ASTM D977, Type SS-1 or RS-1.

908-2.2 Inspection. The ENGINEER shall be notified of sources and quantities of mulch materials available and the Contractor shall furnish him with representative samples of the materials to be used 30 days before delivery to the project. These samples may be used as standards with the approval of the

ENGINEER and any materials brought on the site that do not meet these standards shall be rejected.

CONSTRUCTION METHODS

908-3.1 Mulching. Before spreading mulch, all large clods, stumps, stones, brush, roots, and other foreign material shall be removed from the area to be mulched. Mulch shall be applied immediately after seeding. The spreading of the mulch may be by hand methods, blower, or other mechanical methods, provided a uniform covering is obtained.

Mulch material shall be furnished, hauled, and evenly applied on the area shown on the plans or designated by the ENGINEER. Straw or hay shall be spread over the surface to a uniform thickness at the rate of 2 to 3 tons per acre to provide a loose depth of not less than 1-1/2 inches nor more than 3 inches. Other organic material shall be spread at the rate recommended by the Manufacturer. Mulch may be blown on the slopes and the use of cutters in the equipment for this purpose will be permitted to the extent that at least 95% of the mulch in place on the slope shall be 6 inches or more in length. When mulches applied by the blowing method are cut, the loose depth in place shall be not less than one inch nor more than 2 inches.

908-3.2 Securing Mulch. The mulch shall be held in place by light discing, a very thin covering of topsoil, pins, stakes, wire mesh, asphalt binder, or other adhesive material approved by the ENGINEER. Where mulches have been secured by either of the asphalt binder methods, it will not be permissible to walk on the slopes after the binder has been applied. When an application of asphalt binder material is used to secure the mulch, the Contractor must take every precaution to guard against damaging or disfiguring structures or property on or adjacent to the areas worked and will be held responsible for any such damage resulting from the operation.

If the “peg and string” method is used, the mulch shall be secured by the use of stakes or wire pins driven into the ground on 5-foot centers or less. Binder twine shall be strung between adjacent stakes in straight lines and crisscrossed diagonally over the mulch, after which the stakes shall be firmly driven nearly flush to the ground to draw the twine down tight onto the mulch.

908-3.3 Care and Repair.

A. The Contractor shall care for the mulched areas until final acceptance of the project. Care shall consist of providing protection against traffic or other use by placing warning signs, as approved by the ENGINEER, and erecting any barricades that may be shown on the plans before or immediately after mulching has been completed on the designated areas.

B. The Contractor shall be required to repair or replace any mulch that is defective or becomes damaged until the project is finally accepted. When, in the judgment of the ENGINEER, such defects or damages are the result of poor workmanship or failure to meet the requirements of the specifications, the cost of the necessary repairs or replacement shall be borne by the Contractor.

C. If the “asphalt spray” method is used, all mulched surfaces shall be sprayed with asphalt binder material so that the surface has a uniform appearance. The binder shall be uniformly applied to the mulch at the rate of approximately 8 gallons per 1,000 square feet, or as directed by the ENGINEER, with a minimum of 6 gallons and a maximum of 10 gallons per 1,000 square feet depending on the type of mulch and the effectiveness of the binder securing it. Asphalt binder material may be sprayed on the mulched slope areas from either the top or the bottom of the slope. An approved spray nozzle shall be used. The nozzle shall be operated at a distance of not less than 4 feet from the surface of the mulch and uniform distribution of the asphalt material shall be required. A pump or an air compressor of adequate capacity shall be used to ensure uniform distribution of the asphalt material.

D. If the “asphalt mix” method is used, the mulch shall be applied by blowing, and the asphalt binder material shall be sprayed into the mulch as it leaves the blower. The binder shall be uniformly applied to the mulch at the rate of approximately 8 gallons per 1,000 square feet or as directed by the ENGINEER, with a minimum of 6 gallons and a maximum of 10 gallons per 1,000 square feet depending on the type of mulch and the effectiveness of the binder securing it.

METHOD OF MEASUREMENT

908-4.1 Mulching shall be measured in acres on the basis of the actual surface area acceptably mulched.

BASIS OF PAYMENT

908-5.1 Payment will be made at the contract unit price per acre for mulching. The price shall be full compensation for furnishing all materials and for placing and anchoring the materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item T-908-5.1 Mulching – per Acre

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM D977	Standard Specification for Emulsified Asphalt

Advisory Circulars (AC)

AC 150/5200-33C	Hazardous Wildlife Attractants on or Near Airports

FAA/United States Department of Agriculture

Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM T-908

SECTION 32 90 00

FINAL GRADING AND LANDSCAPING

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. Furnish labor, materials, equipment, and appliances required for complete execution of Work shown on the Drawings and specified herein.

B. The work includes but is not limited to:
1. Landscape finish grading.
2. Preparation of soil
3. Soil amendment and fertilizer.
4. Ornamental containers.
5. Sprigging and seeding.
6. New trees, plants, and ground covers and vines.
7. Mulch and top dressing.
8. Header.
9. Tree supports.
10. Weed and pest control.
11. Maintenance.

1.02 REFERENCES

A. ANSI Z60.1 “American Standard of Nursery Stock.”

B. NAA (National Arborist Association) – Pruning Standards for Shade Trees.

C. FS-O-F-241 – Fertilizers, Mixed, Commercial.

1.03 STANDARDS

A. American Association of Nurserymen, Inc. (AAN) Standard: American Standard for Nursery Stock (ANSSI 260.1-1973)

B. Hortus Third

C. Peat Moss: Peat, Humus; and Peat, Reed Sedge. Federal Specification: Q-P=166E

D. Fertilizers: Mixed Commercial. Federal Specification O-F-241D

E. American Joint Committee on Horticulture Nomenclature “Standardized Plant Names,” latest edition.

F. All plants shall conform to the State of North Carolina Nursery & Landscape Association (NCNLA) standards.

G. All plants shall conform to quantity and quality standards as set forth in USDA Standard for Nursery Stock, Publication No. 260.1.

1.04 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel and Brome Grass.

B. Plants: Living trees, plants, ground cover and grass specified in this Section.

C. Abbreviations:
1. Gal. Gallon
2. O.C. On Center
3. Cal. Caliper
4. C.T. Clear Trunk from Crown of the Ball to the First Branching

1.05 SUBMITTALS

A. Provide submittal data in conformance with Submittals.

B. The landscape contractor shall inspect all plant material upon delivery to site.
1. Associated guarantees shall be submitted to the OWNER.
2. Submittal shall state plants are healthy and free of insects and diseases along with guarantee clause and period of guarantee.

C. Document recommendations for each item from experience during the 90-day maintenance period.

D. Provide warranties for all products.
1. List of dates when applicable guarantees and warranties terminate.

E. Provide soil test reports and associated list of materials and application rates of top dressing, amendments and fertilizer for incorporating into landscape.
1. Provide copies of tags from fertilizer bags utilized during installation.

1.06 QUALITY ASSURANCE

A. Nursery Qualifications: Company and/or individuals specializing in growing and cultivating the plants with ten years documented experience.

B. It is the intention of these Specifications to describe the materials and methods required for the installation of landscape work free from defects in materials and workmanship.
1. Notwithstanding the fact that these Specifications may be deficient in setting forth a complete detailed description of the work to be performed, it shall be the responsibility of the Contractor to install the landscape work fully and completely to the satisfaction of the OWNER or OWNER's Representative.

C. Installer Qualifications: Company specializing in installing and planting the plants with appropriate experience.
1. Contractor shall keep on the work during its progress a competent superintendent and any necessary assistants, all satisfactory to the CONSULTANT.
2. The Superintendent shall not be changed except with the consent of the CONSULTANT and OWNERs Representative unless the Superintendent proves to be unsatisfactory.

D. Tree Pruner Qualifications: Company specializing in pruning trees with proof of Arborist Certification.
E. Tree Pruning: NAA – Pruning Standards for Shade Trees.

F. All Manufactured and/or Processed Materials
1. All materials shall be installed in accordance with the methods, techniques and specifications as set forth by each representative manufacturer.
2. All pertinent descriptive literature issued by any of these manufacturers shall become a part of these specifications.

1.07 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies and soil test reports for fertilizer and amendment composition.

B. Certificate and licenses to apply to pesticides and insecticides.

C. Plant Materials: Described by ASTM Z60.1; free of disease or hazardous insects.

D. Contractor is responsible for pulling all applicable permits with governing municipalities and notifying appropriate agencies prior to work and after to receive certificate of approval and completion.
E. Give adequate and required legal notices to OWNER, utility organizations and governing authorities prior to commencing work.
1. Keep agencies informed of work progress and schedule dates of completion for required inspection by appropriate authorities.
2. Procure required approval notices from each agency and forward to OWNER with copies to CONSULTANT.

F. Coordinate operations with other trades, utility firms, and affected public departments to assure continuity of access and service in conformance with applicable requirements of these organizations.

G. Provide and be responsible for protection of work in this Section until completion and final acceptance of project by OWNER.
1. Repair or replace all damaged or defective work to original specified condition at no additional cost.
2. Contractor shall provide necessary protection for the finished surface material adjacent to his work.

H. Take all necessary precautionary measures for the safety of employees involved in the work and comply with all applicable provisions of Federal, State and Municipal safety laws and building codes to prevent accidents or injury on or about the premises where the work is being performed.

I. Insurance shall be written for not less than any limits of liability specified as part of the Contract.
1. Certificates of such insurance shall be filed with the OWNER.

1.08 DELIVERY, STORAGE AND HANDLING

A. General
1. Store materials only in sections approved by the OWNER's representative.

2. Deliver packaged materials in unopened containers showing weight, analysis and name of manufacturer.
    a. During shipment and storage on site, protect materials from breakage, moisture, heat or other damage.
3. All materials on site are the responsibility of contractor, along with assumption of guarantees and warranties

B. Fertilizer
1. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
2. A list of manufacturer and quantity order shall be documented in writing and forwarded to Engineer.
3. If material is delivered to the site in bulk form, kept neat and covered and/or watered to keep dust down and not have it blown around the site.
4. Provide fertilizer per soil test reports.

C. Plant Materials
1. Shipping shall be scheduled to minimize on site storage of plants.
    a. Stock shall not be shipped until the planting preparations have been completed.
2. Shipment of plants shall be clearly identified, with legible labels stating correct name and size of plant, securely attached to individual plants, or to bundles of like variety and size.
3. During shipment plants shall not be bent, stacked, or bound in a manner that damages bark, breaks branches, deforms root ball, or destroys natural shape.
4. Transport plant material in closed or open vehicles with the entire load properly covered for protection from drying winds, heat, freezing or other exposure that may be harmful.
5. Contractor shall review all plant material upon delivery to the site.
    a. Upon unloading trees and shrubs, contractor shall review each plant material to insure it is healthy and no damage has occurred during shipping and unloading.
    b. Any rejected material shall be coordinated with the nursery regarding restocking and replacement requirements and schedules.
6. If delays beyond the Contractor's control occur after delivery, plants already present on site that have not been installed shall be kept watered and protected from sun, wind, and mechanical damage; root balls shall be covered with topsoil or mulch.
    a. Do not remove container-grown stock from containers until planting time. "Heel in" bare root plants in moist soil immediately upon delivery.
    b. Open bundles of plants and separate the plants before the roots are covered.
    c. Take care to prevent air pockets amount roots when heeling-in.
    d. Keep the roots constantly moist until planted.
    e. The heeling-in grounds shall be well protected, shaded area.
7. All plant material shall be observed and approved by the Contractor for quality, size and variety upon unloading of the truck and prior to installation.
    a. Such approval shall not impair the right of observation and rejection during the progress of the work for size and condition of ball or root, latent defects, diseases or injuries and damage due to handling during moving and installation.
8. Refer to plans for plant list.
    a. Plant list is for guide only.
    b. Quantities, sizes and types of plant material shall be determined by plan review.
    c. Discrepancies in plant count on plan by contractor shall be submitted in writing prior to award of bid.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Do not install plant material when ambient temperatures may drop below 35°F or rise above 100°F.

B. Do not install plant material when wind velocity exceeds 15 mph (48 k/hr).

C. Do not install plant material when soil is saturated and plant pits do not drain.

D. Do not install plant material without water available on site to water plants directly after installation.

E. Contractor is responsible for reviewing site environmental conditions prior to bid submission and during installation of plant material.
1. Any discrepancies or concerns of the landscape subcontractor between environmental site conditions (i.e. soil, water, climate, etc.) and plant material specified in the plans shall be brought to the attention of the CONSULTANT in writing.
2. Conditions shall be reviewed and alternatives recommended.

F. Contractor shall meet with OWNER's representative and general contractor to review all areas on site in which subgrade layers of rock have been identified.

1.10 COORDINATION

A. Coordinate work with General Contractor/CONSULTANT for scheduling, utilities and accesses.

B. The Contractor shall examine the site of work, determine and verify all existing conditions under which he will be obligated to operate in performing the work prior to submission of bid.
1. Written dimensions shall have precedence over scaled dimensions and conditions shown on the drawings.
2. When written dimensions conflict with existing conditions, CONSULTANT shall be notified and shall sign and approve resolution of conflict before proceeding with any work.

C. Prior to commencement of any of the work of this Contract, Contractor shall arrange a conference at the site with the CONSULTANT.
1. The conference will include the Contractor, the Superintendent appointed to oversee the work of this Section, and the CONSULTANT and OWNER's Representative.
2. At least four working days' notice shall be given prior to the conference.

D. Location of planting must be coordinated with building footings, fountain equipment, lighting conduit and irrigation prior to installation.
1. Location of Underground Utilities and Easements: Verify locations of underground utilities and easements prior to the installation of plant material.
2. If any discrepancies occur between plans and site condition, Contractor shall notify the CONSULTANT to review plant location(s) prior to proceeding.

1.11 SOIL TESTING

A. A minimum of six soil tests shall be taken throughout the site under direction of CONSULTANT.
1. Send samples to Department of Agriculture Extension Service or approved private soil testing lab.
2. Soil test results shall identify existing site soil composition and recommended soil amendments and fertilizer specifically addressing existing site soil and the plant material on the drawings.
3. When submitting soil samples provide list of plant material.

4. Identify fertilizer and amendment application rates and frequency.
5. Fertilizers identified in these specifications shall govern prior to soil test results.
6. Any issues or concerns of plant material for this project identified in the soil test results must be forwarded to the CONSULTANT in writing and substitutions shall be reviewed.

1.12 WARRANTY AND GUARANTEES

A. The warranty and guarantee period shall begin upon written approval of substantial completion.

B. Provide one-year warranty for all plant materials

C. Include coverage for one continuous growing season, including one continuous growing season after replacement of dead or unhealthy plants.

D. When replacement plants are required, provide plants of same size and species, planted in the next growing season, with a new warranty commencing on date of replacement.
1. Any plant material that is not healthy, dies, dying or the design value of which, in the opinion of the CONSULTANT, has been so injured or damaged as to render it unsuitable for the purpose intended, shall be replaced immediately by the Contractor at no cost to the OWNER.
2. The removal of plant material, additional fertilizer and topsoil necessary for the replacement, all labor and correction of any damage to the adjacent areas incurred by the Contractor during replacement shall be at the Contractor's expense.

E. Provide OWNER with written warranties and guarantees for all products.
1. Soil compaction shall be guaranteed for 1.5 years against improper compaction, excessive settling, and rapid decomposition of soil.

1.13 MAINTENANCE SERVICE

A. Maintain Landscape for ninety days after written final acceptance by OWNER of the landscape installation.
1. All work shall be continuously maintained in all areas included in the contract during the progress of the work, the maintenance period and until the final acceptance of the maintenance period.

B. Maintain plant material immediately after placement unit plants are well established and exhibit a vigorous growing condition.
1. During the final ninety calendar day maintenance period, all plants and planted areas shall be kept watered.
2. Weeds shall be removed.
3. The entire project shall be so cared for that a neat and clean condition will be presented at all times to the satisfaction of the OWNER.
4. Continue maintenance until final written acceptance of ninety-day maintenance period.

C Maintenance to include:
1. Cultivation and weeding of all planting areas.
2. Applying herbicides for weed control in accordance with manufacturer's instructions.
3. Remedy damage resulting from use of herbicides.
4. Remedy damage from use of insecticides.
5. Irrigating sufficient to saturate root system. Test soil moisture level on weekly basis.
6. Pruning, including removal of dead or broken branches and treatment of pruned areas or other wounds. Shape plants directed by CONSULTANT.

7. Integrated Pest Management system to control disease, insects, fungal and other pathogens.
8. Maintaining wrapping, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.
9. Replacement of mulch.
10. Fertilizing per soil test results.
11. Removal of site trash.

D. Termination of Maintenance Period
1. At the end of the ninety-day maintenance period, the contractor, CONSULTANT and OWNER's representative shall meet on site with the OWNER's maintenance contractor to review site landscaping.
2. The installing landscape contractor is responsible to maintain landscape up to receipt of written approval terminating maintenance period.
3. Any discrepancies between the landscape plans and specifications to the actual installation shall be reviewed and documented in writing at this meeting.
4. During the year guarantee period the maintenance contractor shall notify the OWNERs Representative and installation landscape contractor in writing of any problems/ disease, etc., which may occur to the plant material and impact the guarantee of plant material and warranties to products.

PART 2 – PRODUCTS

2.0 1 PLANT MATERIAL

A. Trees, Shrubs, Ground Cover, and Other Plant Material
1. Species and size identified in plant schedule, grown in climatic conditions acceptable to those in locality of the Work.
2. For clarity of drawing, ground cover symbols are not shown on planting plan sheets in areas covered by shrub symbols.
3. The ground cover indicated adjacent to the shrub symbols shall be planted to within 1'-0" of the base of each shrub as planted.
4. All planting stock shall be nursery grown in accordance with good horticultural practices.
5. Plants shall be free of disease and insects (i.e. eggs, larvae, and defects such as knot, sun-scathe), injuries, abrasions, or disfigurement.
6. Plants shall be sound, healthy and vigorous, of uniform growth, typical of the species and variety, well-formed, free from irregularities with the minimum quality conforming to American Standard of Nursery Stock.

B. Specimens
1. Plants indicated as specimen shall be exceptionally heavy, symmetrical, and tightly knit, cultured, to be unquestionably superior in form, branching, compactness, and symmetry.

C. Size
1. The minimum acceptable sizes of all plants shall be measured before pruning and with branches in normal position.
2. Unless otherwise designated on the plant list, all plant dimensions shall conform to those listed in ANSI A60.1, American Standard for Nursery Stock.
3. Height is indicated with a tolerance.
    a. The smaller dimension is the minimum acceptable; the larger dimension represents the maximum permissible except with approval of CONSULTANT.
4. The average dimension of all plants must at least equal the average of the tolerance figures shown.

5. Spread shall meet the minimum dimensions specified in all directions, and must be considered as pivoting on center of the plant.
    a. Where tolerance is shown between two spread dimensions, the small dimension is the minimum acceptable.
    b. Spread shall average on the median of the range indicated.
6. Caliper is the trunk diameter taken at a specified distance above root collar as described in ANSI Z60.a.
7. Condition is the factor controlled by vitality and ability to survive and thrive and be comparable with normal plants of the same species and variety in the vicinity, at the same season of the year.
8. Branching point is the distance above ground where balanced branching occurs, or where a dimension in trunk appears to form the head of the tree.

D. Plant Selection
1. Root treatments on all plants shall conform to the requirements of ANSI Z60.1.
    a. Plants shall be dug and prepared for shipment in a manner that will not cause damage to branches, shape, and future development after planting.
2. Plant materials shall be subject to approval by the CONSULTANT and/or OWNER's representative at the Nursery prior to delivery and upon delivery to the site before installation.

2.0 2 SUPPLIER QUALIFICATION FOR LAWN

A. Company specializing in growing and cultivating sod with appropriate documented experience.

2.0 3 LAWN SEED

A. 100% Bermuda grass hybrid "Black Jack", "Yukon Gold" or approved equal (ie Tall Fescue, Zenith Zosia, or Centipede depending on region), Fertilizer, Lime, Super Triple Phosphate

2.0 4 SOD

A. Shall be well rooted, 2-year old stock, ASPA Field grown grade; cultivated grass sod; with strong fibrous root system, free of stones, burned or bare spots; containing no more than 5 weeds per 1000 sq. ft., and containing a blend of at least 90% of permanent grasses common to the site location.

B. Type of sod shall be Bermuda "Tif Tuf" or approved equal.

C. The sod shall be top quality certified sod, free of undesirable native grasses, insects and diseases.

D. All sod shall be machine cut and vigorously growing (not dormant).

E. Maximum time from stripping to planting shall be 24 hours.

F. Harvesting Sod:
1. Machine cut sod and load on pallets or rolled in accordance with ASPA Guidelines.
2. Cut sod in area not exceeding 6 sq. ft., with minimum ½ inch and maximum 1-inch topsoil base.
3. Tests for Sod
4. Quality Control

a. Testing Laboratory Services
   i. Provide fertilizer/ soil test reports.
   ii. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
   iii. Submit minimum 10-oz sample of topsoil proposed.
      (a.) Forward sample to approved testing laboratory in sealed containers to prevent contamination.
   iv. Submit report to CONSULTANT.
      (a.) Report is intended to verify supplied topsoil meets specification requirements.

G. Topsoil
1. Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay, or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0.

H. Water
1. Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

2.0 5 SOIL AMENDMENT MATERIALS

A. Fertilizer
1. The following fertilizer recommendations shall govern until soil test results are provided.
   a. Commercial Fertilizers and Amendment for Shrubs, Groundcover and Trees
      i. Gro-Power (12-8-8)
      ii. Gro-Power Plus (5-3-1)
      iii. Agriform Planting Tables, 5, 10, and 21-gram, slow release N-P-K (20-10-5) or CONSULTANT approved equal.

B. Peat
1. Shall be horticultural peat moss composed of not less than 90% decomposed organic matter by weight on oven dried basis.
2. Peat shall be delivered in a workable condition, free of lumps, containing not more than 35% moisture or ash by weight.

C. Fine ground agricultural grade lime/ gypsum
1. Lime shall be ground limestone (Dolomite) containing not less than 85% total carbonates and shall be ground to such fineness that 50% will pass through a 100-mesh sieve and 90% will pass through a 20-mesh sieve.

D. Fertilizer for Lawn Seed or Sod:
1. Commercial fertilizers shall be 16% Nitrogen, 4% Phosphate, 8% potash, and 0-20-0 Super phosphate, and shall conform to the applicable State of North Carolina Board of Agriculture fertilizer laws (or equal if project site is in another state).
2. It shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis.
3. Any fertilizer which becomes caked or otherwise damaged will not be acceptable.
4. Include humic acid as an amendment at the time of soil preparation in heavy clay soils to improve cation exchange capacity in the soil.

E. Topsoil
1. All topsoil to be fertile, friable, natural top-loam

2. All topsoil to be free from alkali, noxious weed seed, admixtures of clay, sub-soil, rocks larger than 1 ½ inches diameter, sticks, debris, construction waste or other foreign matter that would be detrimental to healthy plant growth.
3. Topsoil shall be from project stockpile and sources brought in as needed.
4. Excess Topsoil shall be removed from site unless otherwise approved by the Owner.

F. Water
1. Clean, fresh, and free of substances or matter which could inhibit vigorous growth of plants.
2. Water shall be furnished by OWNER without cost to Contractor.

G. Herbicide
1. Pre-emergent Eptam, granular form.
2. Manufacturer
   a. Stouffer Chemical Company
   b. Ronstar "G,"
   c. Treflan granular
   d. Approved equal.

H. Insecticides
1. Provide insecticides for control of all harmful insects as is necessary to protect all plant materials and as approved by a licensed Pest Control Advisor.
2. Submit all types for approval prior to application.

I. Sand shall be clean, coarse, ungraded, meeting the requirements of ASTM C33 for fine aggregates.

2.0 6 MULCH

1. Lawn Seed - Mulch shall be clean threshed wheat or oat straw from the latest available harvest crop and shall be free of noxious weed seed.

2. Shrubs, Trees and Ground cover – Fresh Long Leaf Pine Needles, Triple Shredded Mulch, Aged Leaf Mold mulch or Arborist Certified Wood chips.
   i. Other recycled on-site materials may be considered for mulching if they are proven to be free of weeds, toxins, or pathogens.

2.0 7 STAKING AND GUYING MATERIALS

A. Alternate guying methods may be proposed by contract and must be approved by CONSULTANT in writing prior to installation.

B. Anchor stakes for guying shall be wood posts 30 inches long.

C. Refer to the landscape drawing for typical tree planting and staking.

D. Wire stays for tree supports shall be pliable, number 12 to 14-gauge galvanized wire.12 inches x 12 inches long non-stretch fabric with grommets.

E. Cable for guying trees shall be $^{3}/_{16}$-inch diameter, 7 strand, cadmium-plated steel.

F. Cable clamps and turnbuckles shall be heavy galvanized or stainless, strong forged steel.

G. Flags for marking guys shall be 48-inch sections of white ¾ inch diameter PVC pipe.

H. Gravel
1. Quality: water worn, hard, durable gravel, washed free of loam, sand, clay, and other foreign substances.
2. Type and size
a. Contractor to provide samples of available gravel.
b. To be selected and approved by the OWNER and CONSULTANT.
i. Size range: ½ inch – ¾ inch.

I. Standpipe
1. 4-inch PVC, Schedule 40 with threaded cap.

2.0 8 WEED AND FUNGUS CONTROL

A. No material or method shall affect the landscape planting and must conform to Federal, State and Local regulations.

B. Application:
1. The applicator of all weed control materials shall be licensed by the State of South Carolina as a Pest Control Operator and a Pest Control Advisor in addition to any subcontractor licenses that are required.

C. Submittals
1. Prior to the installation of any chemical weed control materials, the Pest Control Advisor shall submit to the CONSULTANT a list of the weed control materials and quantities per acre intended for use in controlling the weed types prevalent and expected on the site.
2. Pest Control Advisor shall furnish data to demonstrate the compatibility of the weed control materials and methods with the intended planting and seed varieties.

PART 3 – EXECUTION

3.0 1 EXAMINATION

A. Verify that prepared subsoil is ready to receive work.

B. Saturate soil with water to test drainage.
1. Ensure all landscape areas drain through the sub-surface horizons and over surface to drainage structures.
2. If plant pits do not drain with 24 hours, notify CONSULTANT.

C. Verify that required underground utilities are available, in proper location, and ready for use.
1. Locate all easements and utility locations on as-built planting plans.

D. Landscape Fine Grading
1. All landscape areas shall be graded within approximately $^{1}/_{10}$ (0.10) feet of grades indicated on drawings by others under separate section of the Specifications.
2. If additional soil is necessary to bring grade to proper elevations as specified herein because of unforeseen conditions or circumstances the Contractor shall arrange with the OWNER for installation of imported topsoil based on a per cubic yard cost prior to installation.

a. Under this section all soil shall be brought to grades as indicated on drawings, importing topsoil as necessary and anticipating the installation of soil amenders and settling and/or compaction.
b. Imported soil shall be compacted to a minimum of 80% and a maximum of 85% prior to soil preparation.
c. The soil shall not be worked when the moisture content is so great that excessive compaction will occur nor when it is so dry that clods will not break readily.
d. Water shall be applied, if necessary, to provide ideal moisture for filling and for planting as herein specified.

3. Grades not specifically indicated shall be governed as follows:
   a. 1 ½ inches below adjacent paving.
   b. All areas
      i. Make entire area smooth and even to finish grade.
      ii. Cultivate all areas so that there are no humps or hollows, so that areas drain as indicated.
      iii. Grade to allow free flow of surface water to catch basins (yard drains) and/or away from the areas without it puddling or ponding and/or channeling such that undue erosion could occur.

3.0 2 PREPARATION OF SUBSOIL

A. Prior to the installation of any imported soil, backfill, gravel fill or sub-base, required under the work of this section, the Contractor shall observe the integrity of all water-proofing and damp-proofing membranes which occur over, on, or against any construction which said material is to be installed.

B. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

C. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated soil.

D. Scarify subsoil to a depth of 9 inches in areas to be planted.
   1. Repeat cultivation in areas where equipment, used for hauling and spreading materials on site, has compacted subsoil.
   2. Apply fertilizers and amendments into scarified soil. Incorporate thoroughly into existing site soil.

E. Perform drainage testing on site and in tree well pits to insure positive drainage.

F. All soil polluted by gasoline, oil, plaster, construction debris, or other substances which would render it unsuitable for a proper plant growth medium shall be removed from the premises whether or not such pollution occurs or exists prior to or during the contract period.
   1. In the event that such material is placed by others performing under this contract, the Contractor shall request its removal by the party responsible.
   2. If this is not possible, Landscape Contractor shall remove such material and back charge the party for costs incurred.

G. Elimination of Noxious Grasses
   1. Prior to commencement of soil amending, planting or seeding, all existing strands of noxious grasses including, but not limited to, Nut-Grass, Bermuda Grass (Cynodon Spec.),

Crabgrass (Digitaria Spec.), Dallisgrass (Paspalum dilatatum), Kikuyugrass (Pennisetum cladestinum), and Johnson Grass (Sorghum halepense) shall be killed by means of "Round-up" herbicide by Monsanto Chemical Company, or equal, applied as per manufacturer's recommendations, and under the direction of State Licensed Pest Control Advisor prior to any soil amending, planting or seeding in the area.

2. Contractor shall await the safe time interval before commencing subsequent work.

3.0 3 GENERAL PLANTING

A. Plan drawings indicate the desired size, type and location of plant material and are to be followed as closely as possible.

B. In the event changes from indicated location are deemed necessary by the CONSULTANT, they shall be made by the Contractor without additional cost to the OWNER, provided the change is ordered before the particular plant material is installed, and no significant additional labor or material is required.

C. When plant material is spaced in rows, the total dimension shall be verified and the plants equally spaced within the designated area.

3.0 4 FERTILIZING

A. Refer to soil test reports and/or plans.

B. Apply fertilizer in accordance with soil test results and manufacturer's instructions.

C. Apply during scarify of soil.
1. Mix thoroughly into upper 9 inches of topsoil and backfill for shrubs, groundcover and lawn areas.

D. Lightly water to aid the dissipation of fertilizer or per soil test result directions.

3.0 5 EXCAVATION FOR TREE AND SHRUBS

A. Excavation Pits
1. Beds and trenches with vertical sides and with bottom of excavating slightly raised at center to provide proper drainage.
2. Loosen hard subsoil in bottom of excavation.

B. Drainage testing
1. Fill excavations for trees and shrubs with water and allow percolating out before planting.
   a. Notify CONSULTANT if water does not percolate out within 24 hours.
2. Preliminary solution for tree pits which do not drain is to dig pit 12 inches extra deep for 12-inch layer of gravel.
   a. Drill 12-inch diameter sump at bottom 3'-0" deep or until hole breaks through permeable layer.
   b. Fill with gravel and cover gravel with filter fabric regarding planting detail sheet.
3. No tree shall be planted prior to testing of pits.

4. Plant pits for container grown plants larger than 15-gallon size shall have vertical sides with widths 2 times wider than root ball width and a depth equal to the height of the root ball.
5. Plant pits for container grown plants 1-gallon size to 15-gallon size shall be as follows:

Container Sizes	Plant Width	Pit Depth
1 gallon	12 inches	8.5 inches
3 gallons	18 inches	10 inches
5 gallons	24 inches	11 inches
7 gallons	26 inches	11 inches
15 gallons	36 inches	15 inches
25 gallon	48 inches	18 inches

6. Plant pits for rooted cuttings or seedlings to be at least 6 inches x 6 inches x 6 inches.

3.0 6 PREPARATION OF PLANTING BEDS

A. Planting Pits
1. Planting pits shall be round, with vertical side and flat bottoms and sized in accordance with specified plant types.
2. The vertical sides of the pits, usually burnished to a hard, smooth surface by the process of excavation, shall be scarified, fractured, or otherwise broken down to eliminate the impervious wall.
3. All tree wells are to be drain tested prior to planting. Each hole is to be filled with water and tested for drainage. If holes do not drain in 2-4 hours, notify CONSULTANT.

B. Planting Beds
1. Existing soil in bed areas should be below finished grade and shall be ripped and sub-soiled to a depth of 12-14 inches then rototilled to a depth of 9 inches depth before adding fertilizer and soil amendments.
2. Beds should be checked for possible excavation.
3. Sufficient mixture shall be added to bring the soil to specified grade.
4. Water should be added to settle the mixture to required finish grade including the layer of mulch specified.
5. Verify proper scheduling of soil amending from soil test report recommendations.
6. Pending soil test results, the soil shall be amended as itemized in Section 2.4 unless otherwise noted.
7. General Broadcast Soil Amendments
    a. Thoroughly and uniformly incorporate by mechanical tiller, in two directions, where possible, or by hand tilling, into the top 9 inches of soil, the following per 1000 square feet of on-grade planting area:
        i. 75 pounds of Gro-Power (12-8-8)
        ii. 150 pounds of Gro-Power Plus (5-3-1)
        iii. 20 pounds of Lime

C. Layout
1. Stake locations and outline bed areas and secure CONSULTANT's acceptance before start of planting work.
2. Make minor adjustments as may be necessary with CONSULTANT approval.
3. All easements and underground utilities shall be located prior to staking and locating trees and shrub plantings.

D. Planting Soil Mixture
1. Mix specified soil amendments and fertilizers at rates specified in soil test reports.

2. All planting shall be done in prepared soil composed of the following until soil reports are received.

E. Backfill for plant pits
1. Fill with backfill to proper height to receive the plant, and thoroughly tamp the mixture before setting the plant.
2. Set plant in upright position in the center of the hole, and compact the backfill mixture around the root ball. Top of tree root grown to be 3 inches above finish grade.
3. Thoroughly water each plant when the hole is ⅔ full.
4. After watering, tamp the soil in place until the surface of the backfill is level with the surrounding grade.
    a. For all container-sized plants, backfill shall be a uniform mixture of the following ingredients (by volume):
    i. 50/50 blended compost and native topsoil
    ii. parts by volume on-site soil
    iii. parts by volume nitrogen stabilized organic amendment per manufacturers' recommendation
    iv. 2lbs. Iron sulfate per cubic yard mix
5. For all on-grade planting, backfill shall be amended and a uniform mixture of the following ingredients:

Container Size	Gro-Power Plus (5-3-1)	Gro-Power (12-8-8)	Dolomitic Lime
1 gallon	½ cup	¼ cup	¼ cup
3 gallon	¾ cup	½ cup	½ cup
5 gallon	1 cup	½ cup	½ cup
7 gallon	1 ½ cup	¾ cup	¾ cup
15 gallon	2 cups	1 cup	1 cup
25 gallon	3 cups	1 ½ cup	1 ½ cup
24-inch box	4 cups	2 cups	2 cups
30-inch box	4 ½ cups	2 ¼ cups	2 ¼ cups
36-inch box	5 cups	2 ½ cups	2 ½ cups
42-inch box	5 ½ cups	3 cups	3 cups
48-inch box	6 cups	3 cups	3 cups
54-inch box	7 cups	3 ½ cups	3 ½ cups
60-inch box	9 cups	4 cups	4 ½ cups
72-inch box	12 cups	6 cups	6 cups

6. The above materials should be thoroughly blended prior to use for backfill purposes.
7. The iron sulfate should not contact cement surfaces since severe staining could occur.
8. All backfill shall be installed and semi-compacted in a manner so that after settling, the base of plant stem is flush with adjacent finish grade.
9. During backfilling, place NPK 20-10-3, (20.10.5) gram Agriform planting tablets near, but not in direct contact with the bottom half of the root balls at the following rates:
    a. One tablet per 1-gallon plant.
    b. Two tablets per 5-gallon plant.
    c. Three tablets per 15-gallon plant – 1" caliper.
    d. Five tablets per 24 inch and larger boxes – 2 inches caliper.
    e. Ten tablets per 36-inch box and larger – 3 inches caliper.
    f. NOTE: Contractor may submit alternates to CONSULTANT if soil conditions dictate other mixture. Authorization to substitute must be in writing.

F. Watering Basins

1. For plants within lawn areas, construct a temporary basin around each plant ball immediately after planting.
2. The berm forming the basin shall be continuous and 3 inches above finish grade with the following diameters:
    a. No berm around container plants smaller than 15 gallon
    b. 18 inches for fifteen (15) gallon
    c. 24 inches for 24 inches box
    d. 30 inches for 30 inches box
    e. 36 inches for 36 inches box
    f. 48 inches for 48 inches box

3. Construct a berm 3 inches above finish grade and continuous at the periphery root ball of the plant such as to keep water confined around the root ball.
4. Basins shall have flat bottoms.

3.0 7 PLANTING

A. Lawn Seeding
1. Lime shall be applied to all areas at the rate of 90 pounds per 1000 square feet.
2. 10-10-10 fertilizer shall be applied to all areas at the rate of 20 pounds per 1000 square feet.
3. 0-20-0 super phosphate shall be evenly distributed in all areas at the rate of 12 lbs. per 1000 square feet.
4. Specified turf grass seed shall be evenly distributed over the prepared seedbed of proposed lawn areas at the rate of 6 pounds per 1000 square feet.
    a. Apply annual rye grass at the rate of 2 lbs. per 1000 square feet, only if seeded between October 15 and February 15.
5. Wheat of Oat straw shall be evenly distributed over the prepared seedbed of proposed lawn areas, at the rate of 1 bale per 100-150 square feet to achieve a 1-inch maximum depth.
6. Asphalt tack-coat shall be applied in the method and quantity required to hold mulch together and prevent displacement by wind or surface drainage.
7. All areas shall be seeded, fertilized and mulched evenly at the rate specified, rolled once with a roller weighing not less than 100 pounds per linear foot, tack coated as required and watered thoroughly with a fine spray.
8. Upon approval of the CONSULTANT, the method of seeding may be varied by the Contractor under his responsibility to provide a healthy, vigorous, weed and disease-free lawn.

B. Container Grown Stock
1. Prior to planting flood/ drainage, test each tree pit.
a. Inform CONSULTANT if pits do not drain within 24 hours.
2. Set container grown stock as specified for balled burlapped stock.
3. Remove all plant containers prior to planting; remove bottoms of wooden boxes.
4. After partial backfilling, water and compact soil in layers of 1'-0" up to top of finish grade, add fertilizer to backfill as required.
    a. Form dish of backfill to allow for mulching.

C. Mulching
1. Schedule mulching to take place immediately after planting.
2. Mulch plant beds and individual tree and shrub planting pits to a uniform depth of 3 inches.

3. Mulch shall be kept out of the crowns of shrubs and off building, sidewalks, light standards, and other structures. Mulch and Pine Needles shall be removed from the canopy and foliage of any plants it lands on.
4. Mulch elevation to match adjacent finish grade and paving surface.
5. Mulch lawn areas as required.
6. Rock mulch
    a. Install in a 2-inch layer on top of pervious filter fabric.

D. Pruning
1. Thin out and shape trees and shrubs in accordance with standard arbor culture practice; and only under direction of CONSULTANT.
2. General Pruning
    a. After planting, prune the branches of deciduous stock to balance the loss of roots in such a manner as to retain the natural form of the plant type. Pruning shall be done by persons experienced in this type of work.
    b. Plants shall not be significantly diminished in size.
    c. Trimmings shall be removed from the site.
3. Trees
    a. Prune trees by removing all dead wood, badly formed wood, interfering limbs, and sufficient other growth to insure healthy and symmetrical growth of new wood.
        i. Tree damaged during delivery and planting shall be rejected.
        ii. The proportion, in all cases, must be approved by the CONSULTANT.
    b. In the case of multiple leaders, preserve the one which will best promote the symmetry of the tree, and remove or cut back the remainder so that they will not compete with the selected leader.
        i. Cut back surrounding top branches to conform to the leader.
4. Shrubs
    a. Prune shrubs by removing all dead wood and broken branches, thinning out canes and cutting back or removing unsymmetrical branches.
    b. Pruning shall result in a loose outline conforming to the general shape of the shrub type.
    c. Do not use hedge shears for shrubs which are to be left natural, only on formal creation of hedges.

3.0 8 PLANTING GROUND COVER

A. Spacing
1. Space plants as shown or scheduled

B. Planting
1. Dig holes large enough to allow for spreading of roots and backfill with planting soil.
2. Work soil around roots to eliminate air pockets.
3. Water thoroughly after planting, taking care not to cover crowns of plants with wet soils.

C. Mulch
1. Mulch areas between ground cover plants; place not less than 3 inches thick layers.

3.0 9 WATERING

A. Water plants immediately after planting. Do not allow plants to dry out before or while being planted. Keep exposed roots wet with wet sawdust, peat moss or burlap at all times during planting operations.

B. Once the plants are established, the frequency of watering can be reduced while increasing the duration for each watering.

C. Apply water to planted areas and plants during planting operations and thereafter until acceptance of work.

D. Water plants which cannot be watered efficiently with existing system with a hose.

E. Immediately after planting, apply water to each tree, shrub and vine by means of a hose in a moderate stream in the planting hole until the material about the roots is completely saturated from the bottom of the hole to the top of the ground.

F. Following the planting of ground cover, each plant shall be immediately and thoroughly watered by means of a hose with a slow stream of running water.

G. Apply water in sufficient quantities and as often as seasonal conditions require to keep the ground wet, but not soaking, at all times, well below the root systems of the plants and grass.

3.10 PLANT SUPPORT

A. Staking and Guying
   1. Guying and staking operation shall be completed as shown on the drawing details immediately after planting.
   2. Stakes and guys shall be removed after two growing seasons by the current maintenance provider or owner of the property.
      a. Guy and stake all trees. Three stakes shall be spaced equally about the tree.
      b. Each guy shall consist of two strands of 12 gauge galvanized wire attached to the tree trunk at an angle of about 45° at approximately $^{2}/_{5}$ of the tree height and anchored to the ground with stakes which have been driven into the ground so that the top of the stake is level with finish grades; all guys in patterns determined by CONSULTANT in the field and notched to accommodate the guy wires.
      c. Attachment to the tree trunk shall be with 12 inches long nylon webbing strap with metal grommets looped around the trunk of the tree.

3.11 WEED AND PEST CONTROL

A. Weeding
   1. All planting areas shall be kept weed free during the duration of the Contract.
   2. The Contractor, at his option, may use herbicides but only specified types following the exact recommendations of a North Carolina Licensed Pest Control and of the manufacturers.
   3. If the Contractor is in doubt as to whether a particular ornamental might be harmed by any herbicide, he will manually remove the weeds around the ornamental.

B. Insecticides
   1. The Contractor shall use the appropriate specified insecticides using manufacturer's recommendation during the duration of the Contract to eliminate harmful insects.
   2. Contractor shall verify that a particular insecticide is not corrosive to metal, plastic, or limestone before any spraying.

END OF SECTION 29 90 00

Site Electrical Specifications Table of Contents
For
Harnett Jetport Terminal Site Improvements

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NC License # C-1073

SECTION 26 00 00 SE – ELECTRICAL, BASICS

1.1 RELATED DOCUMENTS

A. These specifications cover site electrical work represented in the site electrical drawings prepared by Cheatham and Associates, P.A.

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

1.2 CONTENTS

A. See Site Electrical Table of Contents.

1.3 GENERAL

A. Applicable requirements of any Instructions to Bidders, General Conditions of the Contract, and/or Supplemental Conditions shall be a part of the Site Electrical Specifications. The electrical contractor shall examine all contract documents before submitting a proposal.

B. The electrical work shall be performed by a licensed electrical contractor, with a license suitable for the scope of work for this specific project.

C. The electrical contractor shall assume total responsibility for any portion of the work provided by his subcontractors.

1.4 CODES AND STANDARDS

A. Building Codes:
1. National Fire Protection Association No. 70, National Electrical Code (NEC)
2. North Carolina State Building Code, Latest Edition and Revisions (NCSBC)
3. National Electrical Safety Code (NESC)
4. National Bureau of Standards (NBS)
5. Local Codes where applicable

B. Industry Standards:
1. Underwriter's Laboratories, Inc. Standards and approved listings (UL)
2. Electrical Testing Laboratories Standards (ETL)
3. National Electrical Manufacturers Association Standards (NEMA)
4. Insulated Power Cable Engineers Association Standards (IPCEA)
5. American National Standards Institute (ANSI)
6. American Society for Testing Materials Standards (ASTM)
7. Canadian Standards Association (CSA)

1.5 SCOPE OF WORK

A. It is the intent and meaning of the drawings and specifications to call for finished work that has been tested and is ready for operation. The electrical contractor shall take this into consideration and include in his proposal allowance for contingencies that will allow him to provide minor pieces of materials and labor not specifically indicated but required for the job to operate properly. This paragraph is intended to insure that a complete job will be provided without requests for minor extras.

B. It shall be understood that where the words “furnish,” “provide,” and/or “install” are used, it is intended that this CONTRACTOR shall purchase and install completely all material necessary and required for this particular item, system, equipment, etc.

1.6 RECORD DRAWINGS

A. A set of drawings covering the electrical contract will be provided to the electrical contractor to mark in color all changes, modifications, or revisions effected during construction. These field mark-up drawings are to be turned over to the electrical designer.

B. The electrical contractor shall provide final installed photographs of switchboards and panelboards. Photographs shall clearly show equipment designations, manufacturer nameplates, breaker positions, breaker ratings, and directory descriptions.

1.7 APPROVAL OF MATERIALS

A. Construction phase: The CONTRACTOR shall submit his proposal on the specified materials and equipment, or their equivalent, provided the words "or equal" or "or approved equal" follow the named manufacturers. If the above phrases do not appear, the specified manufacturers shall be furnished without substitution. Equivalent shall be interpreted to mean an item of material or equipment, similar to that named and which is suitable for the same use and capable of performing the same functions as that named, with the Design Team being the judge of equality.

B. Where no specific material or equipment type is mentioned, any first-class product of a reputable manufacturer may be used provided it conforms to the requirements of the specifications. These materials shall be third party listed or labeled in accordance with the General Statutes of the State (example: UL, ETL, CSA, etc).. This paragraph applies to all electrical specification sections under specification divisions 26, 27, and 28.

1.8 SHOP DRAWINGS AND SUBMITTAL DATA PROCEDURES

A. The CONTRACTOR shall submit PDF files of shop drawings, certified prints, literature, and product data sheets to the Design Team for all major items of equipment and materials for review and approval. It is preferred that all electrical submittals for the project shall be submitted at one and the same time.

B. Product data sheets with multiple components, part numbers, etc. shall be clearly marked to identify what specific product/model/part number is proposed for this project.

C. The CONTRACTOR shall analyze all shop drawings and submittal data and certify that they meet requirements of Contract Drawings and Specifications, prior to delivery to the Design

Team. CONTRACTOR Certification shall be in the form of suitable approval stamp placed on each shop drawing/submittal submitted.

1. If the shop drawings or submittal data deviate from the Contract Documents, the CONTRACTOR shall advise the Design Team of deviations in writing, accompanying the shop drawings and submittal data, including the reason for deviations.

D. If the Design Team deems submittal data is either incomplete or incorrect, a resubmittal will be required. Where a resubmittal is not necessary but confirmation of receipt of review comments is requested, confirmation shall be submitted in writing.

E. At least one set of all final submittal data, shop drawings, certified prints, etc., shall be maintained at the job site and available to representatives of the Design Team.

F. Approval by the Design Team of shop drawings and submittal data is for general conformance with the contract documents and design concept.

1. Such approval does not relieve the CONTRACTOR of responsibility for compliance with the project drawings and specifications.
2. Such approval for any materials, apparatus, devices, and layouts shall not relieve the CONTRACTOR from the responsibility of furnishing same of proper dimensions, size, quantity, quality and all performance characteristics to efficiently complete the requirements and intent of the contract documents.
3. Such approval shall not relieve the CONTRACTOR from responsibility for errors of any sort on the shop drawings.

G. Physical sizes of equipment used in the design layout are those of reputable equipment manufacturers. The CONTRACTOR is responsible for providing equipment that will fit the space available. If the CONTRACTOR elects to use equipment that results in conflicts with space clearance or codes, it shall be the responsibility of the CONTRACTOR to correct at his expense. The CONTRACTOR shall be responsible for providing code clearances. Where equipment is designated for existing space, the CONTRACTOR shall make necessary field measurements to ascertain space requirements, including those for connections; and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the intent and meaning of the drawings and specifications.

H. Catalog Data for OWNER

1. The CONTRACTOR shall provide compilations of catalog data, bound in suitable loose-leaf binders, for each manufactured item of equipment used in the electrical work. These shall be presented to the Design Team for transmittal to the OWNER before the final inspection is made. Data shall include printed installation, operation, and maintenance instructions for each item, indexed by product with heavy sheet dividers and tabs. All warranties shall be included with each item. Each manufacturer’s name, address, and telephone number shall be clearly indicated. Generally, shop drawings and submittal data alone are not adequate for catalog data.

I. Record Documents for OWNER

1. Conductor and cable megger test results.

1.9 DRAWINGS AND SPECIFICATIONS

A. The Site Electrical drawings and specifications are complementary each to the other, and what may be called for by one shall be as binding as if called for by both. The drawings are diagrammatic and indicate generally the location of outlets, devices, equipment wiring, etc and show the general arrangement of raceways, fixtures, and equipment. Drawings shall be followed as closely as actual building construction and the work of other trades will permit; however, all work shall suit the finished surroundings and/or trim.

B. Any omission from either the drawings or the specifications are unintentional, and it shall be the responsibility of the CONTRACTOR to call to the attention of the Design Team any pertinent omissions before submitting a proposal. Complete and working systems are required, whether every small item of material is shown and specified or not.

C. The electrical work shall conform to the requirements shown on all of the drawings. General and Structural drawings shall take precedence over Site Electrical Drawings. Because of small scale of the site electrical drawings, it is not practical to indicate offsets, fittings and accessories that may be required. The CONTRACTOR shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings and accessories as may be required to meet such conditions, without additional cost to the OWNER and as directed by the Design Team.

D. Load circuits shall be installed as indicated on the drawings. Circuit number revisions will not be accepted unless approved in writing by the Engineer.

1.10 COORDINATION OF WORK

A. It is understood and agreed that by submitting a proposal, the CONTRACTOR has, by careful examination, satisfied himself as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the general and local conditions and all other matters which can and may affect the work under this contract. The CONTRACTOR shall be held responsible for visiting the site and thoroughly familiarizing himself with the existing conditions and also any contractual requirements as may be set forth in other divisions of the specifications and in other contract documents. No extras will be considered because of additional work necessitated by obvious job conditions that are not indicated on the drawings.

B. The CONTRACTOR shall compare the site electrical drawings and specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the Design Team. If needed, request from the Design Team written instructions for changes necessary in the electrical work. The electrical work shall be installed in cooperation with other trades installing interrelated work. Before installation, the CONTRACTOR shall make proper provisions to avoid interferences in a manner approved by the Design Team. All changes required in the work of the CONTRACTOR caused by his neglect to do so shall be made by him at his expense.

C. Location of electrical raceways, switches, panels, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The CONTRACTOR shall determine the exact route and location of each electrical raceway prior to make up and assembly.

D. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example; steam, condensate and plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.

E. Offsets and changes in direction of electrical raceways shall be made as required to maintain proper headroom and to clear pitched lines whether or not indicated on the drawings. The CONTRACTOR shall furnish and install elbows, pull boxes, etc., as required to affect these offsets, transitions, and changes in directions. Conflicts between electrical raceways, fixtures, etc., and ductwork which cannot be resolved otherwise, will be resolved by the Design Team.

F. The CONTRACTOR shall install all electrical work to permit removal (without damage to other parts) of any equipment requiring periodic replacement or maintenance. The CONTRACTOR shall arrange electrical raceways and equipment to permit ready access to valves, cocks, traps, starters, motors, control components, etc., and to clear the opening of swinging and overhead doors and of access panels.

G. Work at Existing Facilities:
   1. Where work may be required to be performed at existing and/or occupied facilities, such work shall be scheduled and arranged to be done at the convenience of the OWNER so as not to interfere with, disrupt, or disturb normal operations at the facilities. The CONTRACTOR shall obtain written approval from the OWNER before proceeding with work at existing facilities and shall work at existing facilities on schedule as agreed upon with the OWNER. This is not to be necessarily construed to mean that the CONTRACTOR is expected to perform work at existing facilities on holidays, weekends, etc., but that the Contractor must schedule work with the OWNER for the OWNER's beneficial and normal usage of the facilities, and that the CONTRACTOR will be required to maintain the schedule as approved by the OWNER.
   2. The CONTRACTOR shall, at all times, provide safety barriers, protective devices, screening, dust barriers, etc., as required to maintain the safety and comfort of the building's personnel and/or occupants in or near his work area.
   3. The CONTRACTOR shall be responsible for cleanup in connection with his work at existing facilities. At the end of each working day, all debris, boxes, waste, etc. shall be removed from the facilities and properly disposed of. Equipment, materials, etc. may be left inside the facilities, but such must be properly stored, stacked, and located as approved by the OWNER.
   4. The CONTRACTOR shall do all cutting, patching, finishing, repairing, painting, etc., necessary for electrical work to be installed at existing facilities. All finishes shall be left to equal finish and condition prior to cutting. No cutting of structural members will be allowed. All cutting of walls, floors, roofs, etc. shall be repaired and/or replaced to a finish equal to that found prior to cutting.
   5. The CONTRACTOR shall route conduits and locate equipment as approved by the OWNER and Design Team. Routing and locations shall be firmly established and approved before proceeding with any phase of the work.
   6. The CONTRACTOR shall be responsible for any and all damage to the existing facilities, grounds, walkways, paving, etc. caused by the work, the CONTRACTOR and/or his personnel, and/or his equipment in the accomplishment of this work. Such damages shall be repaired and/or replaced by the CONTRACTOR at his expense, to equal finish prior to damage. The Design Team shall be the judge as to equal finishes, etc.
   7. Certain power requirements must be met without interruption during certain times on the existing electrical system. It is anticipated that partial power outages will be necessary to

accomplish the work covered by these drawings and specifications. The CONTRACTOR shall determine in advance the dates, times and duration of these outages and shall obtain permission from the OWNER to shut down the electric power. Unauthorized power outages will not be tolerated.

H. Equipment and Materials (General):

1. Materials shall be new and shall bear the manufacturer's name, trade name, and listing label in every case where a standard has been established for the particular material. The equipment to be furnished under this specification shall be essentially the standard product of manufacturers regularly engaged in the production of the required type of equipment and shall be the manufacturer's latest approved design.
2. Electrical motors shall meet the minimum efficiency requirements of applicable tables in the North Carolina Energy Conservation Code.
3. Delivery and Storage:
    a. Store products to allow for inspection and measurement of quantity or counting of units.
    b. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
        1) Electrical equipment shall be delivered to the site and stored in original containers. Store protected from the elements, but readily accessible for inspection by the Design Team until installed. Equipment shall be tightly covered and protected against dirt, water and chemical or mechanical injury and theft. Corrosion inhibitors shall be installed in all panelboards, switches, starters and control panels immediately upon receipt. Install one inhibitor for every 8 cubic feet of enclosure volume. Replace inhibitors every 90 days and at final inspection in the Design Team’s presence. Rusty and/or corroded materials and equipment will be replaced at the direction of the Design Team.
        2) Rusty and/or corroded materials and equipment will be replaced at the direction of the Design Team.
    c. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
    d. Protect stored products from damage.
4. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance.
5. At the completion of work; fixtures, equipment, and materials shall be cleaned and polished thoroughly and turned over to the OWNER in a condition satisfactory to the Design Team. Damage or defects, developing before acceptance of the work shall be corrected at the CONTRACTOR's expense.
6. Manufacturer's directions shall be followed completely in the delivery, storage, protection, and installation of all equipment and materials. The CONTRACTOR shall promptly notify the Design Team, in writing, of any conflicts between requirements of the Contract Documents and the manufacturer's directions and shall obtain the Design Team's written instructions before proceeding with the work. Should the CONTRACTOR perform any work that does not comply with the manufacturer's instructions, recommendations, or requirements; it shall be corrected at his expense as directed by the Design Team.

I. Sleeves, Inserts, Openings, Etc.:

1. Anchor bolts, sleeves, inserts, supports, etc., that may be required for electrical work shall be furnished, located, and installed by the electrical contractor. Where working under a subcontract for a General Contractor, the electrical contractor shall give sufficient information (marked and located) to the General Contractor in time for proper placement in the construction schedule. Should the electrical contractor delay or fail to provide sufficient information in time, the electrical contractor shall cut and patch construction as necessary and required to install electrical work, with finishes completed to the satisfaction of the the Design Team.

J. Cutting and Patching:
   1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. The electrical contractor shall be responsible for cutting and patching as required for the proper installation of electrical work for this project. Cutting shall be kept to a minimum. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Finishes shall be restored to the satisfaction of the the Design Team.

K. Locations and Measurements:
   1. Outlets, equipment, fixtures, etc. are shown and located on the drawings as intended based on the Design Team's understood project scope. All measurements for installation shall be verified on the project and coordinated with the drawings of other disciplines. In all cases, work shall suit the surrounding trim and/or decoration and construction. The locations of outlets for appliances shall be installed so that when connected they permit the proper installation of appliances. Slight relocations of outlets, devices, and equipment shall be made by the electrical contractor as required or as directed by the Design Team at no additional cost to the OWNER.

L. Workmanship:
   1. Work shall be executed as required by the drawings and specifications, shall be done in a workmanlike manner by skilled mechanics, and shall present a neat, trim, and mechanical appearance when completed. All work shall be performed as required by the progress of the job.

M. Final Inspections and Equipment Demonstrations:
   1. The CONTRACTOR shall acquire permits for construction & coordinate all required inspections with the office of the local electrical inspector and/or local authority having jurisdiction, if required. The CONTRACTOR shall provide the Owner two (2) copies of Electrical Inspectors' written reports.
   2. The CONTRACTOR shall furnish ladders, required tools, and personnel to open equipment, fixtures, boxes, panels, etc. to enable the Design Team representatives to observe any parts of the installation they may request.

   3. The CONTRACTOR shall furnish meters for observation of readings as directed by the Design Team representative. Meters to be furnished include: clamp-on type ammeter, voltmeter, insulation resistance tester (i.e., often called a megger), and clamp-on type ground resistance tester.

N. Operating Instructions:
   1. At the completion of the entire installation, the CONTRACTOR shall arrange to operate each component of systems and then systems as a whole. When all the requirements of

the plans and specifications have been met, the CONTRACTOR shall then arrange to instruct the OWNER's operating and maintenance personnel in the correct and proper procedures for the operation and maintenance of the systems

END OF SECTION 26 00 00 SE

SECTION 26 05 00 SE - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Supporting devices for electrical components.
   2. Cutting and patching for electrical construction.
   3. Touchup painting.
   4. Electrical demolition.

1.3 SUBMITTALS

A. Product Data:
   1. Support channels and hardware.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Metal Items for Use Indoors: Hot-dip galvanized steel

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.

D. Aluminum Slotted Support Systems: Preformed aluminum channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.

E. Slotted Support Systems Fittings and Accessories: Products of the same manufacturer as channels.

F. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

G. Expansion Anchors: Hot dipped galvanized steel wedge or sleeve type.

H. Toggle Bolts: Hot dipped galvanized steel springhead type.

2.2 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange during progress of construction to facilitate the electrical installations that follow.
   1. Set inserts, sleeves, raceways, boxes, etc. in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.

3.2 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Selection of Supports: Comply with manufacturer's written instructions.

B. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.4 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate pipe hangers or clamps.

F. Install 1/4-inch- diameter or larger threaded hanger rods, unless otherwise detailed.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

I. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

J. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
   1. Wood: Fasten with wood screws or screw-type nails.
   2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
   3. New Concrete: Concrete inserts with machine screws and bolts.
   4. Existing Concrete: Expansion bolts.
   5. Steel: Spring-tension clamps on steel.
   6. Light Steel: Sheet-metal screws.
   7. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.5 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove demolished material from Project site after coordination with the Owner's representative. Equipment and/or materials that the Owner desires to retain shall be moved to a location designated by the Owner's representative.

E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.6 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work.

3.7 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint.
   1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
   2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
   3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.8 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Final Acceptance.

END OF SECTION 26 05 00 SE

SECTION 26 05 19 SE - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

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

B. Field Quality-Control Test Reports: From Contractor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 POWER CONDUCTORS AND CABLES

A. Manufacturers:
1. AFC Cable Systems.
2. Cerro Wire LLC.
3. Colonial Wire and Cable.
4. Encore Wire Corporation.
5. General Cable Corporation.
6. Okonite.
7. Prysmian Group.
8. Republic Wire, Inc.
9. Service Wire.
10. Southwire.
11. Or approved equal.

B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

C. Conductor Material:

1. Copper complying with NEMA WC70 / ICEA S-95-658 solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
2. Power and lighting circuitry: Minimum conductor size shall be #12, and maximum conductor size shall be #500 kcmil.

D. Conductor Insulation Types: Type THHN/THWN-2 complying with NEMA WC70 / ICEA S-95-658.

2.3 CONNECTORS AND SPLICES

A. Manufacturers:
1. AFC Cable Systems.
2. AMP Incorporated/Tyco International.
3. FCI.
4. Greaves Polaris.
5. Hubbell/Anderson.
6. ILSCO.
7. NSI.
8. O-Z/Gedney; EGS Electrical Group LLC.
9. Penn Union.
10. 3M Company; Electrical Products Division.
11. Or approved equal.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
1. For conductors #8 & smaller, use wire-nut type twist connectors.
2. For conductors #6 & larger, use pre-insulated solderless connectors with one spare port for future cable connection.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance, Feeders, Branch Circuits: Type THHN/THWN-2, single conductors in raceway.

3.2 INSTALLATION

A. Use manufacturer-approved pulling compound or lubricant where necessary. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables, conductors, or raceway.

C. Identify and color-code conductors and cables according to Section "Electrical Identification”.

D. Shared neutral conductors shall not be used unless specifically indicated so on homerun circuitry designations on the drawings.

3.3 CONNECTIONS

A. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:
   1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
   2. Inspect for physical damage. test conductors and cable for continuity and shorts.
   3. Insulation Resistance (Megger) testing for building wire and cable:
      a. All current carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. This shall be done with a 500-Volt insulation resistance tester. Insulation resistance testers shall not be electronic type. Insulation resistance testers shall be hand crank or power-driven crank type. Minimum readings between conductors and between conductor and the grounded metal raceway shall be: 25 mega-ohms for #6 wire and smaller; 50 mega-ohms for #4 wire or larger.
      b. The CONTRACTOR shall correct malfunctioning conductors and cables, including replacement if necessary, and retest to demonstrate compliance.
      c. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
   4. Provide tabulated insulation resistance readings for each panel circuit.

C. Witness Tests:
   1. The CONTRACTOR shall furnish an insulation resistance tester and show Design Team representative and/or Owner that the conductors comply with the specified requirements.

END OF SECTION 26 05 19 SE

SECTION 26 05 26 SE - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 QUALITY ASSURANCE

A. Comply with UL 467.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section "Conductors and Cables."

B. Grounding Electrode Conductors: Stranded cable.

C. Bare Copper Conductors: Comply with the following:
   1. Solid Conductors: ASTM B 3.
   2. Assembly of Stranded Conductors: ASTM B 8.
   3. Tinned Conductors: ASTM B 33.

2.2 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

PART 3 - EXECUTION

3.1 APPLICATION

A. In raceways, use insulated equipment grounding conductors.

B. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and circuits.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

3.4 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
   1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
   2. Make connections with clean, bare metal at points of contact.
   3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

END OF SECTION 26 05 26 SE

SECTION 26 05 33 SE - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:
   1. Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. LFMC: Liquidtight flexible metal conduit.

D. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For raceways, fittings, wireways, hinged-cover enclosures, and cabinets.

1.5 FIELD CONDITIONS

A. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

A. Manufacturers:
1. Alflex Inc.
2. Allied Tube and Conduit.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Atkore International / Calbrite.
5. Conduit Pipe Products Company.
6. Electri-Flex Co.
7. Gibson Stainless.
8. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
9. Manhattan/CDT/Cole-Flex.
10. Maverick Tube.
11. O-Z Gedney; Unit of General Signal.
12. Patriot Industries.
13. Republic Conduit.
14. Shaw Stainless and Alloy.
15. Wheatland Tube Co.
16. Or approved equal.

B. Rigid Aluminum Conduit: Produced to ANSI C80.5; listed to UL 6A.

C. Rigid Steel Conduit: Produced to ANSI C80.1; listed to UL 6.

D. FMC: Listed to UL 1.

E. LFMC: Listed to UL 360.

F. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:
1. Allied Tube & Conduit.
2. American International.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Arnco.
5. Blue Diamond Industries.
6. Cantex.
7. Certainteed.
8. Condux International.
9. ElecSYS.
10. Electri-Flex.
11. Heritage Plastics / Atkore International.
12. Kraloy
13. Lamson & Sessions; Carlon Electrical Products.
14. Manhattan/CDT/Cole-Flex.
15. Queen City Plastics.
16. RACO.
17. Southern Pipe, Inc.

18. Spiralduct, Inc./AFC Cable Systems, Inc.
19. Thomas & Betts.
20. Or approved equal.

B. RNC: Produced to NEMA TC 2; listed to UL 651.
1. Schedule 40 and Schedule 80 PVC.

C. RNC Fittings: Produced to NEMA TC 3; listed to UL 514B; match to conduit or tubing type and material.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:
1. Arlington.
2. Austin.
3. B-Line.
4. Cooper Crouse-Hinds.
5. Emerson/General Signal; Appleton Electric Company.
6. Erickson.
7. FSR.
8. Hammond.
9. Hoffman.
10. Hubbell.
11. Milbank.
12. O-Z/Gedney.
13. Peerless.
14. RACO.
15. Robroy Industries.
16. Rose + Bopla.
17. Scott Fetzer Co.; Adalet-PLM Division.
18. Spring City Electrical.
19. Strong.
20. Thomas & Betts.
21. Vynckier.
22. Walker Systems.
23. Woodhead Industries.
24. Or approved equal.

B. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

C. Metal Hinged-Cover Enclosures:
1. Interior Locations: NEMA 250, Type 1 with continuous hinged cover, concealed hinge, and flush latch. Finished inside and out with manufacturer's standard enamel.
2. Exterior Locations: NEMA 250, Type 3R galvanized steel with continuous hinged cover and 3-point latch.
3. Removable interior panel.
4. Metal barriers to separate wiring of different systems and voltages.
5. Accessory feet where required or freestanding applications.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:
   1. Exposed: Rigid metal
   2. Concealed: Rigid metal
   3. Underground, Single Run: RNC.
   4. Underground, Grouped: RNC.
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   6. For grounding electrode conductors: RNC Schedule 80.
   7. Boxes and Enclosures: NEMA 250, Type 3R

B. Indoors:
   1. Exposed, in Airfield Lighting Vault: EMT.
   2. Exposed, Elsewhere: Rigid metal.
   3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
   4. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
      a. Damp or Wet Locations: NEMA 250, Type 4.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

E. Do not install aluminum conduits embedded in or in contact with earth or concrete. For direct burial or concrete encasement or penetrations, coat conduit with asphaltum or bituminous type coating.

3.2 INSTALLATION

A. Keep raceways a minimum of 6 inches away from runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Section "Basic Electrical Materials and Methods."

D. Install temporary closures to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

G. Conduits installed on the inside face of exterior building walls shall be spaced off the wall surface a minimum of ¼" using strut-type channel or "clamp-backs".

H. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
   1. Run parallel or banked raceways together on common supports.
   2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

I. Join raceways with fittings designed and approved for that purpose and make joints tight.

J. Raceway connectors shall be insulated throat type. If uninsulated throat connectors are installed, use insulating bushings to protect conductors.

K. Underground raceways:
   1. Where turning up to cabinets, equipment, poles, etc.; transition from horizontal underground PVC to rigid metal for elbows & raceway stub-ups, unless detailed otherwise.
   2. Stub-up Connections to Equipment:
      a. Extend conduits through concrete floor/slab for connection to equipment.
      b. For equipment subject to vibration or movement, FMC or LFMC may be used 6 inches above the floor to the equipment termination.

L. Terminations:
   1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
   2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
   3. Where using boxes with concentric, eccentric, or over-sized knockouts; provide bonding bushings and jumpers. Size bonding jumpers in accordance with NEC Table 250-122, connecting to the box with ground lugs.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Label each end of pull wires with location of opposite end.

N. Flexible Connections:

   1. Use maximum of 24 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors.
   2. Use LFMC in damp or wet locations.

O. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings and finishes are without damage or deterioration at time of Final Acceptance.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.
   1. Exposed threads on galvanized conduits and fittings, installed outdoors, shall be coated with galvanizing paint or equivalent protective coating.

END OF SECTION 26 05 33 SE

SECTION 26 05 53 SE - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes electrical identification materials and devices intended to comply with NFPA 70, OSHA standards, and authorities having jurisdiction.

1.3 SUBMITTALS

A. Product Data:
   1. For each electrical identification product indicated.
   2. For double coated, adhesive tape product indicated.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 CABLE LABELS

A. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches.

B. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
   1. Not less than 6 inches wide by 4 mils thick.
   2. Compounded for permanent direct-burial service.
   3. Embedded continuous metallic strip or core.
   4. Printed legend indicating type of underground line.

2.2 NAMEPLATES AND SIGNS

A. Engraved Plastic Nameplates and Signs: Engraving stock, plastic laminate, minimum 1/16” thick for signs up to 20 sq. in. and 1/8” thick for larger sizes.

B. Fasteners for Nameplates and Signs:
   1. High performance, double coated tape with adhesive. Design Basis: 3M #06383, or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.

C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before applying.

E. Circuit Identification Labels on Boxes: Panel and circuit number.
   1. Interior Boxes:
      a. Exposed: Pressure-sensitive, self-adhesive plastic label on cover.
      b. Concealed:
         1) Pressure-sensitive, self-adhesive plastic label on cover; or
         2) Permanent marker on cover, legible in a standing position by Design Team and Owner.
   2. Exterior Boxes:
      a. Engraved plastic label on cover; and
      b. Pressure-sensitive, self-adhesive plastic label inside cover.

F. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines; install continuous underground-line warning tape located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

G. Color-Coding of Phase, Neutral, and Ground Conductors: Use the following colors for service, feeder, and branch-circuit phase conductors:

   1.

Configuration	Phase A	Phase B	Phase C	Neutral	Ground
120/240-V, 1 Ph, 3W	Black	Red	N/A	White	Green
120/240-V, 3 Ph, 4W	Black	Orange	Blue	White	Green
120/208-V, 3 Ph, 4W	Black	Red	Blue	White	Green
277/480-V, 3 Ph, 4W	Brown	Orange	Yellow	Gray	Green

   2. For conductors #6 AWG and smaller, factory apply color the entire length of conductors.
   3. For conductors #4 AWG and larger, field apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.

4. At each panelboard, a color code legend shall be permanently posted corresponding to the conductors and voltage in that panelboard.

H. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment. Attached engraved labels with high performance double coated adhesive tape. Apply labels for each unit of the following categories of equipment:
1. Switchgear, panelboards, electrical cabinets, and enclosures.
2. Disconnect switches and enclosed circuit breakers.
3. Transformers.
Transfer switches.

Nameplate colors shall be: White surface with black core.

END OF SECTION 26 05 53 SE

SECTION 26 22 00 SE - DRY-TYPE TRANSFORMERS (600 V AND LESS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
   1. Buck-boost transformers.

1.3 SUBMITTALS

A. Product Data Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Shop Drawings: Wiring and connection diagrams.

1.4 QUALITY ASSURANCE

A. Comply with IEEE C 57.12.91, “Standard Test Code for Dry-Type Distribution and Power Transformers”.

B. Comply with IEEE C 57.96, “Guide for Loading Dry-Type Distribution and Power Transformers”.

C. Comply with IEEE C 57.110, “Recommended Practice for Establishing Transformer Capability When Supplying Non-sinusoidal Load Currents”.

D. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

A. Coordinate installation of wall-mounting and structure-hanging supports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Acme Electric Corporation; Power Distribution Products Division.
   2. Eaton / Cutler-Hammer.
   3. GE Electrical Distribution & Control.
   4. Hammond Power Solutions.
   5. Siemens Energy & Automation, Inc.
   6. Sola/Hevi-Duty Electric.
   7. Square D / Schneider.

2.2 MATERIALS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices, except for taps.
   1. Internal Coil Connections: Brazed or pressure type.
   2. Coil Material: Copper or aluminum.

2.3 BUCK-BOOST TRANSFORMERS

A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.

B. Buck-boost transformers shall provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals

C. Enclosure: Ventilated, NEMA 250, Type 2. Finish Color: Gray.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls and floors for suitable mounting conditions where transformers will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

B. Install floor-mounting transformers level on concrete bases. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit and 4 inches high. Reinforce concrete bases with welded wire fabric.

3.3 CONNECTIONS

A. Ground equipment according to Section "Grounding and Bonding”.

B. Connect wiring according to Section "Conductors and Cables”.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION 26 22 00 SE

SECTION 26 24 16 SE - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Distribution panelboards.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      a. Enclosure types and details for types other than NEMA 250, Type 1.
      b. Trim types and details.
      c. Bus configuration, current, and voltage ratings.
      d. Short-circuit current rating of panelboards and overcurrent protective devices.
      e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Panelboard Schedules: For installation in panelboards.

D. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

B. Comply with NEMA PB 1.

1.5 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. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Panelboards, Overcurrent Protective Devices, and Accessories:
      a. Eaton Corporation; Cutler-Hammer Products.
      b. General Electric Co.; Electrical Distribution & Protection Div.
      c. Siemens Energy & Automation, Inc.
      d. Square D.

2.2 MANUFACTURED UNITS

A. Enclosures: Flush- and surface-mounted cabinets, as scheduled in the drawings. NEMA PB 1, Type 1.
   1. Rated for environmental conditions at installed location.
      a. Outdoor Locations: NEMA 250, Type 3R
   2. Front Cover: Doors with concealed hinges; secured with flush latch with tumbler lock; keyed alike.
   3. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

B. Phase Buses:
   1. Material: Hard-drawn copper, 98 percent conductivity.

C. Ground and Neutral Bars:
   1. Material: Copper.
   2. Equipment Ground Bar: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
   3. Neutral Bar: Adequate for feeder and branch-circuit neutral conductors.

D. Conductor Connectors: Suitable for use with conductor material.
   1. Main and Neutral Lugs: Mechanical type.
   2. Ground Lugs and Bus Configured Terminators: Mechanical or compression type.

E. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices. These locations will be indicated as SPACE on the panel schedules in the drawings.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 OVERCURRENT PROTECTIVE DEVICES

A. Main Overcurrent Protective Devices: Circuit breaker, where scheduled.

B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

C. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:
      a. Instantaneous trip.
      b. Long- and short-time pickup levels.
      c. Long- and short-time time adjustments.
      d. Ground-fault pickup level, time delay, and I^2t response.

D. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
   1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   2. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 74 inches above finished floor, unless otherwise indicated.

C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Install overcurrent protective devices and controllers. Set field-adjustable circuit-breaker trip ranges. Prepare documentation of circuit breaker trip settings for Owner record documents.

E. Panel breaker configurations shall be installed as indicated on the panel schedules or as noted. Breaker position revisions will not be accepted unless approved in writing by the Engineer.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

G. Install filler plates in unused spaces.

3.2 IDENTIFICATION

A. Create a directory to indicate installed circuit loads. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

B. Panelboard Nameplates: Label each panelboard with laminated-plastic nameplate mounted as specified in Section "Electrical Identification".

3.3 CONNECTIONS

A. Ground equipment according to Section "Grounding and Bonding".

B. Connect wiring according to Section "Conductors and Cables".

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.
   3. Neutral–ground bond testing: After all fixtures, devices and equipment are installed and all connections completed to each panel, the CONTRACTOR shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and grounded enclosure. If this reading is less than 25 mega-ohms, the CONTRACTOR shall disconnect the branch circuit neutral wires from the neutral bar. The CONTRACTOR shall then test each one separately to the panel until the low reading ones are found. The CONTRACTOR shall correct troubles, re-connect, and re-test until at least 25 mega-ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.

B. Perform the following field tests and inspections and prepare test reports:
   1. Perform each electrical test and visual and mechanical inspection stated in manufacturer's installation instructions for molded-case circuit breakers.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 24 16 SE

SECTION 26 28 16 SE - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
   1. .
   2. Molded-case circuit breakers.
   3. Enclosures.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
   1. Enclosure types and details for types other than NEMA 250, Type 1.
   2. Current and voltage ratings.
   3. Short-circuit current rating.
   4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1.4 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:
   1. Eaton Corporation; Cutler-Hammer Products.
   2. General Electric Co.; Electrical Distribution & Control Division.
   3. Siemens Energy & Automation, Inc.
   4. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
      a. .

C. Molded-Case Circuit-Breaker Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.

2.3 DOUBLE THROW SWITCHES

A. Manufacturers:
   1. ABB.
   2. Eaton Corporation; Cutler-Hammer Products.
   3. ESL Power Systems.
   4. General Electric Co.; Electrical Distribution & Control Division.
   5. Siemens Energy & Automation, Inc.
   6. Square D/Group Schneider

B. Lockable handle(s) with capability to accept padlocks and interlocked with cover in closed position.

C. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
   3. Lugs: Mechanical type, suitable for number, size, and conductor material.
   4. Connectors for generator connection as indicated in the drawings.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
   1. Indoor Locations: NEMA 250, Type 1.
   2. Outdoor Locations: NEMA 250, Type 3R

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Temporary Lifting Provisions: After placement, remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 IDENTIFICATION

A. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Section "Electrical Identification".

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:
   1. Inspect mechanical and electrical connections.
   2. Verify switch type and labeling verification.
   3. Verify rating of installed fuses. Verify that installed fuse ratings are visible.
   4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

B. Perform the following field tests and inspections and prepare test reports:
   1. Perform each electrical test and visual and mechanical inspection stated in manufacturer's installation instructions for switches and molded-case circuit breakers.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 26 28 16 SE